9. Flood Control and Management

9.1 Introduction

This chapter describes the flood hydrology, control, and management system in the Primary, Secondary, and Extended study areas, with particular focus on the Primary Study Area and Sacramento River Basin. Descriptions and maps of these three study areas are provided in Chapter 1 Introduction.

The regulatory setting for flood hydrology, control, and management is discussed briefly in this chapter, and is presented in greater detail in Chapter 4 Environmental Compliance and Permit Summary.

This chapter focuses primarily on the Primary Study Area. Potential impacts in the Secondary Study Area, particularly related to the Sacramento River Flood Management System, were evaluated and discussed qualitatively. The portions of the Extended Study Area that are located outside of the Project flood control and management impacted areas were not evaluated or discussed. Potential local and regional impacts from constructing, operating, and maintaining the alternatives were described and compared to applicable significance thresholds. Mitigation measures are provided for identified significant or potentially significant impacts, where appropriate.

9.2 Affected Environment

This section describes flood control and management facilities in the three study areas, with particular focus on the Primary Study Area (including local flood management facilities) and the Secondary Study Area (including the Sacramento River flood management system).

9.2.1 Extended Study Area

The Extended Study Area includes the entire statewide CVP and SWP service areas. This study area is extensive and includes hundreds, if not thousands, of federal, State, regional and local flood control and management facilities. This study area encompasses the CVP and SWP service areas outside of the greater Sacramento River Basin and south of the Sacramento-San Joaquin Delta. The only Extended Study Area reservoir included in Project operations modeling is San Luis Reservoir. However, San Luis Reservoir is operated entirely as a joint CVP and SWP supply storage reservoir and is not operated for flood control purposes. The portions of the Extended Study Area that are outside of the greater Sacramento River Basin, and south of the Sacramento-San Joaquin Delta, would also be outside of the affected environment for Project flood impacts, and are, therefore, not discussed.

9.2.2 Secondary Study Area

9.2.2.1 Sacramento River Flood Control and Management

The Sacramento River flood control and management system is a complex network of dams and reservoirs, levees, weirs, bypasses and other flood control features. A portion of this complex flood protection system includes State- and federally-authorized projects for which the Central Valley Flood Protection Board (CVFPB) or DWR has provided assurances of cooperation to the federal government. This portion of the flood protection system is known as the State Plan of Flood Control (SPFC). A summary of features of the SPFC is provided in Figure 9-1.

The CVFPB or DWR has not provided assurances of cooperation for all parts of the flood protection system. Projects without CVFPB or DWR assurances are not part of the SPFC (i.e., they are non-SPFC facilities). Although these facilities are not part of the SPFC, their operation may influence operation of the SPFC, especially in reducing peak flood flows through the SPFC levee system. Non-SPFC facilities include multipurpose reservoir projects (with the exception of Lake Oroville, which is the only major multipurpose project discussed in this chapter that is part of the SPFC), local and regional projects, non-project levees, local pumping plants, and State-designated floodways (DWR, 2010).

Multipurpose flood management reservoirs in the greater Sacramento River Basin are listed in Table 9-1 in chronological order of construction.

Table 9-1
Sacramento River Basin Multi-Purpose Flood Management Reservoirs

Reservoir	Total Reservoir Capacity (acre-feet)	Maximum Flood Storage Capacity (acre-feet)	Operator
Shasta	4,550,000	1,300,000	Reclamation
Black Butte	160,000	137,000	USACE
Folsom	1,010,000	650,000	Reclamation
Oroville	3,540,000	750,000	DWR
New Bullards Bar	960,000	170,000	Yuba County Water Agency
Indian Valley	300,000	40,000	Yolo County Flood Control and Water Conservation District

Notes:
USACE = U.S. Army Corps of Engineers
DWR = California Department of Water Resources
Reclamation = U.S. Bureau of Reclamation

Other major SPFC facilities in the Sacramento River flood control and management system include project levees and flood control weirs, as shown on Figures 9-2A and 9-2B. These figures also indicate system capacities and flood flow routing.

The 100-year floodplain delineations for the Sacramento River Valley north of the Sacramento-San Joaquin Delta are illustrated on Figure 9-3. Major federal, State and local non-SPFC projects impacting flood hydrology or providing flood management for the Sacramento Valley are located on the Trinity River, Sacramento River, Feather River, American River and within the Delta. These areas are discussed below.

9.2.2.2 Trinity River (Including Trinity Lake, Lewiston Lake, Whiskeytown Lake, Clear Creek and Spring Creek)

The Trinity River is the largest tributary to the Klamath River. The Trinity River Diversion includes Trinity Dam, Lewiston Dam, and facilities to transfer water from the Trinity River Basin to the Sacramento River Basin. Trinity Dam was completed in 1962. The dam forms Trinity Lake, which has a capacity of approximately 2.4 MAF. Releases from Trinity Dam are regulated downstream at Lewiston Lake for downstream flow requirements and diversions through the Clear Creek Tunnel to Whiskeytown Lake on Clear Creek. From Whiskeytown Lake, water is delivered through the Spring Creek tunnel to Keswick Reservoir. The outflow from Trinity and Lewiston reservoirs provides water to meet temperature objectives for special-status fish species in the Trinity and upper Sacramento rivers (Reclamation, 2009).

Flood control was not an original project purpose of the two dams. However, because of its large storage and spillway surcharge capacities, Trinity Lake has the potential to provide flood control storage, and Reclamation’s Safety of Dams criteria stipulate flood control releases November through March if the overall storage is forecasted to exceed 2.0 MAF (Reclamation, 2004). In addition, Trinity Lake is operated in conjunction with Shasta Lake, when necessary, as part of Shasta's Sacramento River flood control operations.

9.2.2.3 Sacramento River (Including Shasta Lake and Keswick Reservoir)

A complex system of dams and associated reservoirs, levees, weirs, bypasses and other features have been constructed over the last 150 years to help manage flooding along the Sacramento River. The primary flood control features on the Sacramento River system are Shasta Lake and the federally authorized Sacramento River Flood Control Project.

Regulating inflows from the Sacramento, McCloud, and Pit rivers, Shasta Lake provides flood control to the upper Sacramento River through Shasta Lake's 1.3-MAF of flood control storage. The reservoir is managed for flood control from October 1 through March 30. In non-emergency flood conditions, Shasta Dam releases are restricted to 79,000 cfs at the tailwater of Keswick Dam (79,000 cfs is the estimated safe channel carrying capacity of the Sacramento River downstream of Keswick through Redding) and by a flood stage of 27.0 feet at the Sacramento River at Bend Bridge gage (flood stage of 27.0 ft equates to approximately 100,000 cfs). The Sacramento River at Bend Bridge is a key Sacramento River flood forecasting point. The Sacramento River Flood Control Project area spans from Red Bluff to Verona (north of Sacramento on the Sacramento River) and includes levees, cleared channels, bypasses, and overflow flood control facilities (Figures 9-2A and 9-2B).

The Chico Landing to Red Bluff reach of the Sacramento River (RM 194 to RM 244) is relatively unaffected by flood control facilities. The river naturally meanders through alluvial deposits, and tributaries contribute unregulated flood inflows. This reach of the Sacramento River Flood Control Project was authorized in 1958 for bank protection and incidental channel modification. Floodway designation and floodplain planning and zoning are used to prevent encroachment into the natural floodplain. Most of the floodplain along this reach is used primarily for either agricultural production or riparian habitat. The 100-year floodplain can range up to four miles wide. Some rural residential development has occurred along the river, with concentrated urban development around the City of Tehama and Hamilton City. The design flow of the river upstream of Chico Landing is 260,000 cfs.

The Colusa to Chico Landing reach of the Sacramento River (RM 143 to RM 194) consists of levees and overflow areas. Black Butte Reservoir regulates Stony Creek flood flows, which enter the Sacramento River downstream of Hamilton City. Right bank levees extend south from Ord Ferry through Colusa to prevent Sacramento River flood water from entering the Colusa Basin, except when flows exceed 300,000 cfs near Ord Ferry (USACE, 1999). Three flood relief weirs, downstream of Chico Landing, spill flood flows to the Butte Basin Overflow Area, which consists of lands that have historically flooded prior to flood control development. The left bank levee begins midway between Ord Ferry and Butte City and extends south through Verona. The leveed capacity of the Sacramento River near Butte City is 160,000 cfs. Moulton and Colusa weirs divert flood flows to the Butte Basin Overflow Area at RM 158 and 146, respectively. The capacity of Moulton and Colusa weirs is 25,000 and 70,000 cfs, respectively. These weirs provide relief to meet the downstream river capacity of 65,000 cfs at Colusa.

The natural Sutter Basin overflow to the east of the Sacramento River and downstream of the Sutter Buttes was included in the Sacramento River Flood Control Project by confining the extent of overflow through a leveed bypass. The Sutter Bypass conveys floodwaters from the Butte Basin Overflow Area, Butte Creek, Wadsworth Canal, Reclamation Districts 1660 and 1500 drainage plants, State drainage plants 1, 2 and 3, and Tisdale Weir to the juncture of the Sacramento and Feather rivers. The capacity of the Sutter Bypass is 216,000 cfs upstream of its juncture with the Feather River, where the combined capacity of the Feather River and Sutter Bypass is 416,500 cfs upstream of its confluence with the Sacramento River at Fremont Weir and the Yolo Bypass.

The natural Yolo Basin overflow to the west of the Sacramento River was included in the Sacramento River Flood Control Project by confining the extent of overflow through a leveed bypass. The Yolo Bypass conveys floodwaters around the Sacramento metropolitan area and reconnects to the Sacramento River at Rio Vista (RM 14), near Suisun Bay (USACE, 1999). Overflow into the Bypass occurs at Fremont Weir to the north and at Sacramento Weir near Sacramento. Fremont Weir flow begins when flows in the Sacramento River reach 62,000 cfs. Capacity of the Bypass increases from 343,000 cfs at Fremont Weir to 500,000 cfs near the bypass' mouth at Rio Vista.

The Verona to Colusa reach (RM 98 to RM 143) consists of a leveed river channel. Downstream of Colusa, Tisdale Bypass routes a portion of the river flow in excess of 23,000 cfs at Tisdale Weir (RM 119) to the Sutter Bypass (USACE, 1999). Reclamation Districts 70, 108, and 787 pump flood waters from adjacent closed basin lands into the river. The Knights Landing Outfall is a gravity flow structure and prevents the Sacramento River from flowing into the Colusa Basin. The Knights Landing Ridge Cut conveys Colusa Basin drainage and flood flows into the Yolo Bypass several miles downstream of Fremont Weir. Flood flows passing through the Knights Landing Ridge Cut are somewhat restricted at times by backwater conditions when the Yolo Bypass is at full capacity. Sources of bypass inflow downstream of the Knights Landing Ridge Cut include the Cache Creek Detention Basin, Willow Slough, Putah Creek, and Sacramento Weir (combination of Sacramento and American river flood flows). Near Verona, the Sacramento River, Feather River, Sutter Bypass, and Natomas Cross Canal join together, and flows in excess of 62,000 cfs spill into the Yolo Bypass at Fremont Weir.

Downstream of Verona, the leveed Sacramento River winds its way past the City of Sacramento to the Sacramento-San Joaquin Delta. The Yolo Bypass is located to the west of the river. The Sacramento Bypass routes excess flows at Sacramento Weir (RM 63) to the Yolo Bypass (USACE, 1999). The American River flows into the Sacramento River at RM 60. Flows from the Yolo Bypass re-enter the river near Rio Vista (RM 14). Between the American River and Yolo Bypass junction, portions of the Sacramento River water are divided among several sloughs.

The capacity of the leveed Sacramento River at various locations is listed in Table 9-2.

Table 9-2
Sacramento River Leveed Capacity

Location	Flow (cfs)
Upstream of Moulton Weir	160,000 cfs
Moulton Weir to Colusa Weir	135,000 cfs
Colusa Weir to Butte Slough Outfall Gates	65,000 cfs
Butte Slough Outfall Gates to Tisdale Weir	66,000 cfs
Tisdale Weir to Freemont Weir	30,000 cfs
Freemont Weir to Sacramento Weir	107,000 cfs
Sacramento Weir to Sutter Slough	110,000 cfs
Sutter Slough to Steamboat Slough	85,000 cfs
Steamboat Slough to Georgiana Slough	56,500 cfs
Georgiana Slough to Yolo Bypass Junction	35,900 cfs
Yolo Bypass Junction to Threemile Slough	579,000 cfs
Threemile Slough to Collinsville	514,000 cfs

Source: DWR, 2009.

9.2.2.4 Feather River (Including Lake Oroville and the Thermalito Complex)

The mainstem of the Feather River is regulated by Oroville Dam, which is part of the SWP and SPFC. The dam was completed in 1968 and forms a 3.5-MAF capacity Lake Oroville. From Lake Oroville, the Feather River flows south through the Sacramento Valley where it is joined by two major tributaries. The Yuba River joins the Feather River at Marysville; the Bear River confluence is approximately 15 miles farther downstream. The Feather River then joins the Sacramento River at RM 80.

Operation of the Oroville facilities varies depending upon hydrology and DWR's objectives. Similar to Shasta, Lake Oroville stores winter and spring runoff for release to the Feather River, as necessary, for project purposes. Typically, releases to the Feather River are managed to conserve water while meeting a variety of water delivery requirements, including flow, temperature, fisheries, diversions, and water quality.

Lake Oroville's flood control storage volume varies from 375 to 750 TAF, depending on hydrologic conditions. Flood management releases are based upon a schedule and diagram prepared by USACE (DWR, 2007). Pursuant to USACE's flood control regulations, the maximum controlled release capacity is 150,000 cfs.

The right bank (looking downstream) of the Feather River is leveed downstream of the Thermalito Afterbay to Honcut Creek. Both banks of the river are leveed downstream of Honcut Creek. These levees and the river are part of the Sacramento River Flood Control Project. The capacity of the leveed Feather River at various locations is listed in Table 9-3.

Table 9-3
Feather River Leveed Capacity

Location	Flow (cfs)
Upstream of Yuba River	210,000
Yuba River to Bear River	300,000
Bear River to Sutter Bypass	320,000

Source: DWR, 2009.

9.2.2.5 American River (Including Folsom Lake and Lake Natoma)

Folsom Lake has a maximum capacity of approximately 1 MAF and is located on the American River approximately 15 miles northeast of the City of Sacramento, near the City of Folsom. Construction of the dam was completed in 1956. It is managed by Reclamation to provide flood control, recreation, power, water supply, Delta water quality protection, and fish flows in the American River and Delta (Reclamation, CCWD, and WAPA, 2009). Lake Natoma is located downstream of Folsom and functions primarily as a regulating reservoir to lessen Folsom releases.

The flood control storage volume of Folsom Lake varies from 400 to 670 TAF. The objective release to the American River is 115,000 cfs (Reclamation, 2008). The American River downstream of Carmichael Bluffs is part of the Sacramento River Flood Control Project. The capacity of the leveed reach upstream of Cal Expo (RM 5) is 115,000 cfs, and downstream to the Sacramento River, the capacity is 180,000 cfs.

9.2.2.6 Sacramento-San Joaquin Delta (Including Suisun, San Pablo, and San Francisco Bays)

The Sacramento-San Joaquin Delta, located to the east of San Francisco Bay, represents the point of discharge for the Sacramento-San Joaquin River system. Water flows out of the Delta, through Suisun and San Pablo bays, into San Francisco Bay, and to the Pacific Ocean, creating an extensive estuary where salty ocean water and fresh river water mix. In sum, water from over 40 percent of the State's land area is discharged into the Delta (Reclamation, CCWD, and WAPA, 2009).

The Delta is a complex system of levees, constructed waterways, and control facilities. The levee system is composed entirely of local levees maintained by local interests (DWR, 2009). These levees were initially constructed to control island flooding during high flow, but because of island subsidence, they now have to prevent inundation during normal runoff and tidal cycles (Reclamation and DWR, 2005). There are approximately 1,100 miles of levees providing protection to 76 islands and tracts. Construction and operation of the CVP and SWP has decreased the frequency of levee failure due to overtopping during flood events (Reclamation and DWR, 2005).

9.2.3 Primary Study Area

The larger streams in the Primary Study Area are Funks Creek, Stone Corral Creek, and the Colusa Basin Drain, which are discussed below. The Colusa Basin Drain is a designated floodway according to the Central Valley Flood Protection Board (CVFPB). The 100-year floodplain delineations for the Primary Study Area, depicting areas subjected to flooding and areas with undetermined flood hazards[1], are shown on Figure 9-4. Areas with undetermined flood hazards include the national wildlife refuges, which are not subject to the FEMA's National Flood Insurance Program regulations.

9.2.3.1 Funks and Stone Corral Creeks

Funks and Stone Corral creeks are ephemeral streams that originate on the westside foothills and are tributary to the Colusa Basin Drain. Snow pack is non-existent due to the low elevation of the watershed. Flood runoff is generated directly from large precipitation events. This area is primarily agricultural with rural farmsteads and small communities. The gentle sloping lands are ideal for rice production and managed wetlands, which also contribute to large areas of inundation during flood events. Road, bridge, railroad, and canal alignments can affect the movement of flood water in this area.

The drainage area of Funks Creek at Funks Dam is 43 square miles. Funks Reservoir is not operated for flood control purposes. There are no stream gages on Funks Creek downstream of Funks Dam because a historical stream gage was washed out and not replaced due to the constantly degrading channel. Peak winter flows of approximately 2,000 cfs are common (TCCA, 2005). Because the topography and soil composition of the watershed are similar to those of Stone Corral Creek, where stream flow records are available, and given the comparable drainage areas of the two watersheds, it is reasonable to assume that the 100-year discharge on Funks Creek is similar to that of Stone Corral Creek.

During a 100-year flood event, Funks Creek overflows its bank downstream of the T-C Canal and Funks Reservoir. Flood waters flow to the north along the creek and to the south where they join with Stone Corral Creek. Stone Corral Creek overflows its bank downstream of the town of Sites. The floodplains of both Funks and Stone Corral creeks are intersected by the GCID Canal, which has levees along each bank.

[1] Neither peak flow nor base flood elevations are available from the FEMA Flood Insurance Study. Instead, areas subject to flooding are depicted.

The drainage area of the Stone Corral Creek watershed is 38.2 square miles at a former gaging station near the town of Sites. Twenty-five years of discharge measurements were collected, with interruption from 1958 through 1985 by the U.S. Geological Survey. During that time, there were three years of zero flow: 1972, 1976, and 1977. A maximum mean daily flow of 2,230 cfs occurred on December 24, 1983. An instantaneous peak flow of 5,700 cfs was recorded on January 26, 1983. The 100-year peak discharge upstream of Sutton Road (aka Cemetery Road), west of Maxwell, is 3,650 cfs, and the 100-year peak discharge downstream of the California Northern Railroad is 3,330 cfs (FEMA, 2003).Flooding in the town of Maxwell occurs directly from Stone Corral Creek and overland flow from Funks Creek. Both I-5 and the Union Pacific Railroad significantly impede the movement of flood flows through Maxwell. Downstream of I-5, Funks and Stone Corral creeks combine and create a single floodplain that moves in a southeasterly direction toward the Colusa Basin Drain.

9.2.3.2 Colusa Basin Drain

Runoff from 11 stream systems draining the foothill and valley floor watersheds contribute flow to the Colusa Basin Drain. This natural historic drainage system for the Colusa Basin has been almost entirely cut off from receiving floodwaters of the Sacramento River by an extensive levee system (except when flood flows on the Sacramento River exceed 300,000 cfs near Ord Ferry). In general, the Colusa Basin Drain conveys flood flows from November through March and agricultural irrigation and drainage flows from April through October. Its northern half is unleveed. Beginning south of Colusa, left bank levees extend southward to its confluence with the Sacramento River. Both Reclamation District 787 and Reclamation District 108 pump drainage from interior lands surrounded by levees to either the Sacramento River or the Colusa Basin Drain.

Both flood and drainage flows are regulated by the Knights Landing Outfall Gates. These gates prevent Sacramento River water from entering the basin. The magnitude of gravity flow from the Colusa Basin Drain is controlled by the water surface elevation in the Sacramento River and the gate openings.

The Knights Landing Ridge Cut provides flood relief to the Colusa Basin Drain by conveying flood and drainage water to the Yolo Bypass if discharge to the river cannot occur. The Knights Landing Ridge Cut design capacity is 20,000 cfs (DWR, 2010). The combined capacity of the Ridge Cut and the Outfall gates are insufficient at times to carry flood flows out of the basin, resulting in backwater conditions and inundation along the drain, especially in its lower reaches. Areas of 100-year flood inundation (Figure 9-4) reflect the limited capacity of the Knights Landing Ridge Cut and the Colusa Basin Drain’s 100-year flood flow at SR 20 of 34,500 cfs (FEMA, 2003). These problems have been the focus of ongoing studies by the Colusa Basin Drainage District to reduce damages to agricultural production.

9.3 Environmental Impacts/Environmental Consequences

9.3.1 Regulatory Setting

Flood hydrology and flood control are regulated at the federal, State, and local levels. Provided below is a list of the applicable regulations. These regulations are discussed in detail in Chapter 4 Environmental Compliance and Permit Summary of this EIR/EIS.

9.3.1.1 Federal Plans, Policies, and Regulations

- Executive Order 11988 (Floodplain Management)
- Clean Water Act, Section 408

- Federal Emergency Management Agency's National Flood Insurance Program
- Federal Emergency Management Agency Flood Zones and Flood Zone Regulations
- Federal Emergency Management Agency Levee Design and Maintenance Regulations
- Federal Emergency Management Agency 100-year Protection Standard
- Flood Control Act of 1936
- USACE Rehabilitation and Inspection Program
- Operations and Maintenance Controls, Flood Control Projects
- Rivers and Harbors Act of 1899

9.3.1.2 State Plans, Policies, and Regulations

- Central Valley Flood Protection Board Approval
- Assembly Bill 1200
- FloodSAFE California Initiative
- The State Plan of Flood Control Descriptive Document
- Senate Bill 5
- Assembly Bill 162
- California Water Code Section 8609
- California Water Code Division 3: Dams and Reservoirs
- Sacramento-San Joaquin River Basin Comprehensive Study
- Sacramento River Flood Control Project
- Sacramento River Bank Protection Project

9.3.1.3 Regional and Local Plans, Policies, and Regulations

- Colusa County General Plan
- Glenn County General Plan
- Colusa County Code, Chapter 33: Flood Damage Prevention
- Colusa County Flood Control and Conservation District
- Colusa County Floodplain Administrator

9.3.2 Evaluation Criteria and Significance Thresholds

Significance criteria represent the thresholds that were used to identify whether an impact would be significant. Appendix G of the *CEQA Guidelines* suggests the following evaluation criteria for flood control and management:

*Would the Project***:**

- Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner which would result in substantial erosion or siltation on- or off-site?
- Place within a 100-year flood hazard area structures which would impede or redirect flood flows?
- Expose people or structures to a significant risk of loss, injury or death involving flooding, including flooding as a result of the failure of a levee or dam?
- Create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff?

- Place housing within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map?

The evaluation criteria used for this impact analysis represent a combination of the Appendix G criteria and professional judgment that considers current regulations, standards, and/or consultation with agencies, knowledge of the area, and the context and intensity of the environmental effects, as required pursuant to NEPA. For the purposes of this analysis, an alternative would result in a significant impact if it would result in any of the following:

- Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner which would result in substantial erosion or siltation on- or off-site?
- Place within a 100-year flood hazard area structures which would impede or redirect flood flows?
- Expose people or structures to a significant risk of loss, injury or death involving flooding, including flooding as a result of the failure of a levee or dam?

9.3.3 Impact Assessment Assumptions and Methodology

9.3.3.1 Assumptions

The following assumptions were made regarding Project-related construction, operation, and maintenance impacts to flood control and management:

- Direct Project-related construction, operation, and maintenance activities would occur in the Primary Study Area.
- Direct Project-related operational effects would occur in the Secondary Study Area.
- The only direct Project-related construction activity that would occur in the Secondary Study Area is the installation of an additional pump into an existing bay at the Red Bluff Pumping Plant.
- The only direct Project-related maintenance activity that would occur in the Secondary Study Area is the sediment removal and disposal at the two intake locations (i.e., GCID Canal Intake and Red Bluff Pumping Plant).
- No direct Project-related construction or maintenance activities would occur in the Extended Study Area.
- Direct Project-related operational effects that would occur in the Extended Study Area are related to San Luis Reservoir operation; increased reliability of water supply to agricultural, municipal, and industrial water users; and the provision of an alternate Level 4 wildlife refuge water supply. Indirect effects to the operation of certain facilities that are located in the Extended Study Area, and indirect effects to the consequent water deliveries made by those facilities, would occur as a result of implementing the alternatives.
- The existing bank protection located upstream of the proposed Delevan Pipeline Intake/Discharge facilities would continue to be maintained and remain functional.
- No additional channel stabilization, grade control measures, or dredging in the Sacramento River at or upstream of the Delevan Pipeline Intake or Discharge Facilities would be required.

- All dams would be designed to be resistant to various failure modes. Dam safety at both Golden Gate and Sites dams would be monitored by instrumentation, measuring such parameters as seepage, settlement and earthquake-induced accelerations.
- Sites Reservoir would be designed to safely store the Probable Maximum Flood (PMF) without overtopping the dam. For both reservoir size options (i.e., 1.27-MAF and 1.81-MAF) included in the alternatives, the design includes a storage buffer more than 2.5 times larger than required to hold the PMF estimated inflow.
- All three proposed reservoirs (Sites, Holthouse, and TRR) would be designed with emergency spillways to prevent overtopping the dams.
- Sites Reservoir, given its proposed storage capacity, would be designed for a required maximum emergency drawdown release of 23,000 cfs, which would be released through the inlet/outlet works to quickly drain the reservoir, if needed. In addition, the Holthouse Reservoir design would require a spillway sufficient to pass the required Sites Reservoir maximum emergency drawdown release flow of 23,000 cfs.

9.3.3.2 Methodology

The SWP and CVP operations model (water resources simulation model known as CALSIM II) was used to simulate CVP and SWP operations to determine the surface water flows, storages, and deliveries associated with the baseline (i.e., Existing Conditions), No Project/No Action Alternative, and the three action alternatives (Alternatives A, B, and C). A detailed description of the assumptions used for modeling the baselines and the alternatives is included in Appendix 6A. The water resources system models used are described in Appendix 6B. The CALSIM II model was used to simulate system operations for an 82-year period using a monthly time-step. The model included assumptions regarding facilities, land use, water supply contracts, and regulatory requirements for Existing Conditions and the No Project/No Action Alternative. The historical 82-year flow record (1922 to 2003), adjusted for the influences of land use changes and upstream flow regulation, was used to represent the possible range of water supply conditions. Major Central Valley rivers, reservoirs, and CVP/SWP facilities were represented by a network of arcs and nodes. CALSIM II used a mass balance approach to route water through this network. Simulated flows represented mean flows for the month; reservoir storage volumes corresponded to end-of-month storage.

CALSIM II modeled a complex and extensive set of regulatory standards and operations criteria. Descriptions of the modeling assumptions are contained in Appendix 6A. The analysis conducted used the best available tools to approximate systemwide changes in storage, flow, salinity, and reservoir system reoperation associated with the alternatives.

CALSIM II modeling followed all flood control operations rules for existing reservoirs and flood management facilities (i.e., encroachments into the flood control space of existing reservoirs was not allowed). However, CALSIM II's predictive capability is limited and cannot readily be applied to analyzing flood flows and hourly, daily, or weekly time steps for hydrologic conditions. Changes to the extents of the Sacramento River 100-year floodplain cannot be determined fully without operation criteria and model output for hourly, daily, or weekly time steps for hydrologic conditions. CALSIM II uses a monthly time step, which is inappropriate for flood control analysis. Thus, CALSIM II was not used to evaluate changes to the Sacramento River 100-year floodplain.

Of the five large reservoirs in the Secondary Study Area included in the CALSIM II operations modeling, only Shasta, Oroville, and Folsom reservoirs are operated officially with flood control as a primary objective.

9.3.4 Topics Eliminated from Further Analytical Consideration

The proposed Project facilities would all be located in rural and agricultural areas that are not serviced by existing or planned stormwater drainage systems. Therefore, the potential impact to a stormwater drainage system (**Impact Flood-4**) from Project implementation is not relevant to the Project, and is not discussed in this chapter.

In addition, no new housing is proposed as part of the Project. Therefore, potential impacts from placing housing within a flood hazard area (**Impact Flood-5**) from Project implementation is not relevant to the Project, and is not discussed in this chapter.

9.3.5 Impacts Associated with the No Project/No Action Alternative

9.3.5.1 Extended Study Area – No Project/No Action Alternative

Construction, Operation, and Maintenance Impacts

Agricultural, Municipal, Industrial, and Wildlife Refuge Water Use, and San Luis Reservoir

Impact Flood-1: Substantially alter the Existing Drainage Pattern of the Site or Project Area, Including through the Alteration of the Course of a Stream or River, or Substantially Increase the Rate or Amount of Surface Runoff in a Manner which would Result in Flooding On- or Off-site

The No Project/No Action Alternative includes implementation of projects and programs being constructed, or those that have gained approval, as of June 2009. The impacts of these projects have already been evaluated on a project-by-project basis, pursuant to CEQA and/or NEPA, and their potential for altering existing drainage patterns, stream courses, or surface runoff has been addressed in those environmental documents. Therefore, **there would not be a substantial adverse effect** on existing drainage patterns, stream courses, or surface runoff, when compared to Existing Conditions.

Population growth is expected to occur in California throughout the period of Project analysis (i.e., 100 years), and is included in the assumptions for the No Project/No Action Alternative. A larger population could result in increased demand for water supplies within the Extended Study Area service areas. Changes in water supply deliveries and the possible associated changes in water elevation fluctuations at San Luis Reservoir would not alter existing drainage patterns and stream courses, or increase surface runoff. A larger population, with the expected increase in urban development, could be expected to alter existing drainage patterns and stream courses, and increase surface runoff. These impacts that would occur as a result of the increased population would be managed at the local level (e.g., cities and counties) in accordance with those agencies' regulations. Therefore, **there would not be a substantial adverse effect,** when compared to Existing Conditions.

Impact Flood-2: Place within a 100-year Flood Hazard Area Structures which Could Impede or Redirect Flood Flows

Refer to the **Impact Flood-1** discussion. That discussion is also applicable to flood flows.

Impact Flood-3: Expose People or Structures to a Significant Risk of Loss, Injury, or Death from Flooding, Including Flooding as a Result of the Failure of a Levee or Dam

Refer to the **Impact Flood-1** discussion. That discussion is also applicable to flooding as a result of the failure of a levee or dam.

9.3.5.2 Secondary Study Area – No Project/No Action Alternative

Construction, Operation, and Maintenance Impacts

Trinity Lake, Lewiston Lake, Trinity River, Klamath River Downstream of the Trinity River, Whiskeytown Lake, Spring Creek, Shasta Lake, Sacramento River, Keswick Reservoir, Clear Creek, Lake Oroville, Thermalito Complex (Thermalito Diversion Pool, Thermalito Forebay, and Thermalito Afterbay), Feather River, Sutter Bypass, Yolo Bypass, Folsom Lake, Lake Natoma, American River, Sacramento-San Joaquin Delta, Suisun Bay, San Pablo Bay, San Francisco Bay

Impact Flood-1: Substantially alter the Existing Drainage Pattern of the Site or Project Area, Including through the Alteration of the Course of a Stream or River, or Substantially Increase the Rate or Amount of Surface Runoff in a Manner which would Result in Flooding On- or Off-site

Refer to the **Impact Flood-1** discussion for the Extended Study Area. That discussion is also applicable to the Secondary Study Area.

Impact Flood-2: Place within a 100-year Flood Hazard Area Structures which Could Impede or Redirect Flood Flows

Refer to the **Impact Flood-1** discussion for the Extended Study Area. That discussion is also applicable to the Secondary Study Area.

Impact Flood-3: Expose People or Structures to a Significant Risk of Loss, Injury, or Death from Flooding, Including Flooding as a Result of the Failure of a Levee or Dam

If the No Project/No Action Alternative is implemented, current levels of flooding within the Secondary Study Area would not increase, when compared to Existing Conditions. The 100-year flood flows and resulting flood levels within the greater Sacramento River Basin and its associated flood control features would remain unchanged. In turn, the 100-year discharge and inundation areas, as shown on the FEMA floodplain maps, would remain unchanged with the No Project/No Action Alternative.

No Project/No Action Alternative operations modeling results indicate minor changes in Sacramento River basin reservoir levels and flood flows as indicated by end of month storage/water surface elevation and river flow conditions provided in Appendix 6B.

Tables 9-4, 9-5, 9-6, and 9-7 indicate potential impacts to several flood control reservoirs in the Secondary Study Area as a measure of surface water elevation.

Table 9-4
Shasta Lake End of Month Elevation Long-Term Average and Average by Water Year Type for the No Project/No Action Alternative when Compared to Existing Conditions

Analysis Period	End of Month Elevation (Feet)											
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Long-Term												
Full Simulation Period[a]												
Existing Condition	980	979	987	1,001	1,015	1,030	1,041	1,042	1,030	1,008	993	984
No Project/No Action Alternative	980	980	988	1,002	1,015	1,030	1,042	1,042	1,029	1,008	992	984
Difference	0	0	1	0	0	0	0	0	0	0	0	-1
Percent Difference(%)[b]	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1
Water Year Types[c]												
Wet (32%)												
Existing Condition	1,009	1,004	1,010	1,024	1,033	1,042	1,059	1,064	1,057	1,042	1,029	1,013
No Project/No Action Alternative	1,008	1,003	1,010	1,024	1,033	1,042	1,059	1,064	1,057	1,042	1,029	1,012
Difference	-1	-1	0	0	0	0	0	0	0	-1	0	-2
Percent Difference (%)	-0.1	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	0.0	-0.2
Above Normal (15%)												
Existing Condition	1,006	1,002	1,010	1,011	1,024	1,046	1,062	1,064	1,052	1,030	1,016	1,010
No Project/No Action Alternative	1,004	1,001	1,009	1,010	1,023	1,045	1,062	1,064	1,051	1,030	1,015	1,008
Difference	-2	-1	-1	-1	-1	0	0	0	0	-1	-1	-2
Percent Difference (%)	-0.2	-0.1	-0.1	-0.1	-0.1	0.0	0.0	0.0	0.0	-0.1	-0.1	-0.2

[a]Based on the 82-year simulation period.
[b]Relative difference of the monthly average.
[c]As defined by the Sacramento Valley 40-30-30 Index Water Year Hydrologic Classification (SWRCB, 1999).

Table 9-5
Trinity Lake End of Month Elevation, Long-Term Average and Average by Water Year Type for the No Project/No Action Alternative when Compared to Existing Conditions

Analysis Period	End of Month Elevation (Feet)											
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Long-Term												
Full Simulation Period[a]												
Percent Difference (%)[b]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Water Year Types[c]												
Wet (32%)												
Percent Difference (%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Above Normal (15%)												
Percent Difference (%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1

[a]Based on the 82-year simulation period.
[b]Relative difference of the monthly average.
[c]As defined by the Sacramento Valley 40-30-30 Index Water Year Hydrologic Classification (SWRCB, 1999).

Table 9-6
Lake Oroville End of Month Elevation, Long-Term Average and Average by Water Year Type for the No Project/No Action Alternative when Compared to Existing Conditions

Analysis Period	End of Month Elevation (Feet)											
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Full Simulation Period[a]												
Percent Difference (%)[b]	-0.6	-0.5	-0.5	-0.4	-0.3	-0.2	-0.2	-0.1	-0.2	-0.3	-0.4	-0.6
Water Year Types[c]												
Wet (32%)												
Percent Difference (%)	-0.9	-0.8	-0.6	-0.2	-0.1	0.0	0.0	0.0	0.0	-0.2	-0.5	-0.9
Above Normal (15%)												
Percent Difference (%)	-0.5	-0.5	-0.5	-0.2	-0.1	-0.1	-0.1	0.0	0.0	-0.2	-0.4	-0.5

[a]Based on the 82-year simulation period.
[b]Relative difference of the monthly average.
[c]As defined by the Sacramento Valley 40-30-30 Index Water Year Hydrologic Classification (SWRCB, 1999).

Table 9-7
Folsom Lake End of Month Elevation, Long-Term Average and Average by Water Year Type for the No Project/No Action Alternative when Compared to Existing Conditions

Analysis Period	End of Month Elevation (Feet)											
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Full Simulation Period[a]												
Percent Difference (%)[b]	-0.4	-0.3	-0.3	-0.2	0.0	0.1	-0.1	-0.1	-0.2	-0.5	-0.5	-0.4
Water Year Types[c]												
Wet (32%)												
Percent Difference (%)	-0.2	-0.2	-0.1	0.0	0.1	0.0	0.0	-0.1	-0.1	-0.2	-0.2	-0.2
Above Normal (15%)												
Percent Difference (%)	-0.5	-0.4	-0.4	-0.1	0.1	0.2	0.0	0.0	-0.2	-0.3	-0.7	-0.4

[a]Based on the 82-year simulation period.
[b]Relative difference of the monthly average.
[c]As defined by the Sacramento Valley 40-30-30 Index Water Year Hydrologic Classification (SWRCB, 1999).

Table 9-4 shows the average Shasta Lake end of the month water surface elevation for the No Project/No Action Alternative, when compared to Existing Conditions over the long-term and by water year type. The Wet and Above Normal year types are listed in the table because flooding is most likely to occur during these water year types. The long-term average water surface elevation changes would range between -0.1 and 0.1 percent. Changes for Wet and Above Normal years would range between 0.2 and 0.0 percent for both year types.

Tables 9-5, 9-6, and 9-7 indicate similar impacts at Trinity, Oroville, and Folsom reservoirs. Therefore, implementation of the No Project/No Action Alternative **would not have a substantial adverse effect** to flood risks, including potential flooding due to a levee or dam failure, when compared to Existing Conditions.

9.3.5.3 Primary Study Area – No Project/No Action Alternative

Construction, Operation, and Maintenance Impacts

Impact Flood-1: Substantially alter the Existing Drainage Pattern of the Site or Project Area, Including through the Alteration of the Course of a Stream or River, or Substantially Increase the Rate or Amount of Surface Runoff in a Manner which would Result in Flooding On- or Off-site

Projects considered within the No Project/No Action Alternative are not located within the Primary Study Area. In addition, none of the proposed Project facilities would be constructed if this alternative is implemented. Local hydrology and drainage within the Primary Study Area would, therefore, be expected to remain substantially the same. Implementation of the No Project/No Action Alternative **would not have a substantial adverse effect** on existing drainage patterns, stream courses, or surface runoff, when compared to Existing Conditions.

Impact Flood-2: Place within a 100-year Flood Hazard Area Structures which Could Impede or Redirect Flood Flows

Refer to the **Impact Flood-1** discussion. That discussion is also applicable to the Primary Study Area.

Impact Flood-3: Expose People or Structures to a Significant Risk of Loss, Injury, or Death from Flooding, Including Flooding as a Result of the Failure of a Levee or Dam

Refer to the **Flood-1** discussion. All existing facilities would be subject to current levels of flooding. The 100-year flood flows and resulting levels for Funks and Stone Corral creeks and the Colusa Basin Drain would remain unchanged. The 100-year discharge and inundation as shown on the FEMA floodplain maps would also likely remain unchanged with the No Project/No Action Alternative. Therefore, implementation of the No Project/No Action Alternative **would not have a substantial adverse effect** on flood risks, including potential flooding due to a levee or dam failure, when compared to Existing Conditions.

9.3.6 Impacts Associated with Alternative A

9.3.6.1 Extended Study Area – Alternative A

Construction, Operation, and Maintenance Impacts

Agricultural, Municipal, Industrial, and Wildlife Refuge Water Use, and San Luis Reservoir

Impact Flood-1: Substantially alter the Existing Drainage Pattern of the Site or Project Area, Including through the Alteration of the Course of a Stream or River, or Substantially Increase the Rate or Amount of Surface Runoff in a Manner which would Result in Flooding On- or Off-site

There would be no direct Project-related construction or maintenance occurring within the CVP and SWP service areas of the Extended Study Area; therefore, no Project-related flooding would occur, resulting in **no impact** in the Extended Study Area, when compared to Existing Conditions and the No Project/No Action Alternative.

If Alternative A is implemented, changes in SWP and CVP service area water supply deliveries and surface water elevation fluctuations at San Luis Reservoir would not alter existing drainage patterns, stream courses, or surface runoff within the Extended Study Area. Therefore, operation of Alternative A would result in **no impact** on existing drainage patterns, stream courses, or surface runoff within the Extended Study Area, when compared to Existing Conditions and the No Project/No Action Alternative.

Impact Flood-2: Place within a 100-year Flood Hazard Area Structures which Could Impede or Redirect Flood Flows

If Alternative A is implemented, no new Project-related structures would be constructed within the Extended Study Area, thus no 100-year flood flows would be impeded or redirected by their placement. Therefore, operation of Alternative A would result in **no impact** on 100-year flood flows within the Extended Study Area, when compared to Existing Conditions and the No Project/No Action Alternative.

Impact Flood-3: Expose People or Structures to a Significant Risk of Loss, Injury, or Death from Flooding, Including Flooding as a Result of the Failure of a Levee or Dam

San Luis Reservoir is operated entirely as a joint CVP and SWP supply storage reservoir and is not operated for flood control purposes. If Alternative A is implemented, water level fluctuations that would occur at San Luis Reservoir would fall within the historic range of operation and would not expose people or structures to any additional flooding risks related to dam failure. Thus, operation of Alternative A would result in **no impact** due to increased flooding risks, including potential flooding due a levee or dam failure, within the Extended Study Area, when compared to Existing Conditions and the No Project/No Action Alternative.

9.3.6.2 Secondary Study Area - Alternative A

Construction, Operation, and Maintenance Impacts

Trinity Lake, Lewiston Lake, Trinity River, Klamath River Downstream of the Trinity River, Whiskeytown Lake, Spring Creek, Shasta Lake, Sacramento River, Keswick Reservoir, Clear Creek, Lake Oroville, Thermalito Complex (Thermalito Diversion Pool, Thermalito Forebay, and Thermalito Afterbay), Feather River, Sutter Bypass, Yolo Bypass, Folsom Lake, Lake Natoma, American River, Sacramento-San Joaquin Delta, Suisun Bay, San Pablo Bay, San Francisco Bay

Impact Flood-1: Substantially alter the Existing Drainage Pattern of the Site or Project Area, Including through the Alteration of the Course of a Stream or River, or Substantially Increase the Rate or Amount of Surface Runoff in a Manner which would Result in Flooding On- or Off-site

If Alternative A is implemented, no direct Project-related construction would occur at any of the above-listed facilities or areas within the Secondary Study Area other than the installation of one additional pump into an existing bay at the Red Bluff Pumping Plant. The additional pump would not alter the existing drainage pattern of the site, alter a stream course, or increase the amount of surface runoff. Therefore, the installation of a pump at the existing Red Bluff Pumping Plant would result in **no impact** on existing drainage patterns, stream courses, or surface runoff within the Secondary Study Area, when compared to Existing Conditions and the No Project/No Action Alternative.

Impact Flood-2: Place within a 100-year Flood Hazard Area Structures which Could Impede or Redirect Flood Flows

If Alternative A is implemented, a new pump at the Red Bluff Pumping Plant would be installed in an existing pump bay. It would not impede or redirect 100-year flood flows. Therefore, construction, operation, and maintenance of Alternative A would result in **no impact** on 100-year flood flows within the Secondary Study Area, when compared to Existing Conditions and the No Project/No Action Alternative.

Impact Flood-3: Expose People or Structures to a Significant Risk of Loss, Injury, or Death from Flooding, Including Flooding as a Result of the Failure of a Levee or Dam

If Alternative A is implemented, the additional pump at the Red Bluff Pumping Plant would be installed in an existing bay and would not modify any existing levees. Therefore, installation of the additional pump would have no effect on existing dams or levees within the Secondary Study Area. When compared to Existing Conditions and the No Project/No Action Alternative, construction, operation and maintenance of Alternative A would result in **no impact** due to increased flooding risks, including potential flooding due a levee or dam failure**.**

Tables 9-8 through 9-15 indicate potential minor operational impacts to several flood control reservoirs in the Secondary Study Area if Alternative A is implemented as a measure of average surface water elevation.

Table 9-8 shows the average Shasta Lake end of the month water surface elevation for Alternative A, when compared to Existing Conditions over the long-term and by water year type. The Wet and Above Normal year types are shown because flooding is most likely to occur during these water year types. Long-term average water surface elevation changes would range between 0.1 and 0.6 percent. Changes during Wet years would range between 0.0 and 0.2 percent, and changes during Above Normal years would range between -0.2 and 0.3 percent.

Table 9-9 shows the same information for Shasta Lake, when compared to the No Project/No Action Alternative. Long-term average water surface elevation changes would range between 0.0 and 0.6 percent. Wet year changes would range between 0.0 and 0.3 percent, and Above Normal year changes would range between -0.1 and 0.5 percent.

Tables 9-10 through 9-15 indicate similar impacts at Trinity, Oroville, and Folsom reservoirs.

As indicated by the water surface elevation data, coordinated operation with Sites Reservoir would not increase flood risks due to significantly higher water surface elevations in flood control reservoirs in the Secondary Study Area during Wet and Above Normal water year types. Therefore, compared to both Existing Conditions and the No Project/No Action Alternative, construction, operation and maintenance of Alternative A would result in a **less-than-significant impact** due to increased flooding risks, including potential flooding due a levee or dam failure, within the Secondary Study Area.

Table 9-8
Shasta Lake End of Month Elevation, Long-Term Average, and Average by Water Year Type for Alternative A when Compared to Existing Conditions

Analysis Period	End of Month Elevation (Feet)											
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Long-Term												
Full Simulation Period[a]												
Existing Condition	980	979	987	1,001	1,015	1,030	1,041	1,042	1,030	1,008	993	984
Alternative A	985	984	991	1,003	1,015	1,031	1,043	1,045	1,033	1,013	997	989
Difference	5	5	3	2	1	1	2	3	4	4	5	5
Percent Difference (%)[b]	0.5	0.5	0.3	0.2	0.1	0.1	0.2	0.3	0.4	0.4	0.5	0.5
Water Year Types[c]												
Wet (32%)												
Existing Condition	1,009	1,004	1,010	1,024	1,033	1,042	1,059	1,064	1,057	1,042	1,029	1,013
Alternative A	1,010	1,006	1,011	1,024	1,033	1,042	1,059	1,064	1,057	1,042	1,030	1,014

Table 9-8
Shasta Lake End of Month Elevation, Long-Term Average, and Average by Water Year Type for Alternative A when Compared to Existing Conditions

Analysis Period	End of Month Elevation (Feet)											
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Difference	1	2	1	0	0	0	0	0	0	0	1	1
Percent Difference (%)	0.1	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1
Above Normal (15%)												
Existing Condition	1,006	1,002	1,010	1,011	1,024	1,046	1,062	1,064	1,052	1,030	1,016	1,010
Alternative A	1,008	1,004	1,009	1,010	1,022	1,045	1,061	1,064	1,052	1,031	1,018	1,013
Difference	2	2	-1	-1	-2	-1	-1	-1	0	1	2	3
Percent Difference (%)	0.2	0.2	-0.1	-0.1	-0.2	-0.1	-0.1	-0.1	0.0	0.1	0.2	0.3

[a]Based on the 82-year simulation period.
[b]Relative difference of the monthly average.
[c]As defined by the Sacramento Valley 40-30-30 Index Water Year Hydrologic Classification (SWRCB, 1999).

Table 9-9
Shasta Lake End of Month Elevation, Long-Term Average, and Average by Water Year Type for Alternative A when Compared to the No Project/No Action Alternative

Analysis Period	End of Month Elevation (Feet)											
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Long-Term												
Full Simulation Period[a]												
No Project/No Action Alternative	980	980	988	1,002	1,015	1,030	1,042	1,042	1,029	1,008	992	984
Alternative A	985	984	991	1,003	1,015	1,031	1,043	1,045	1,033	1,013	997	989
Difference	5	5	3	2	0	1	2	3	4	5	5	6
Percent Difference(%)[b]	0.5	0.5	0.3	0.2	0.0	0.1	0.2	0.2	0.4	0.5	0.5	0.6
Water Year Types[c]												
Wet (32%)												
No Project/No Action Alternative	1,008	1,003	1,010	1,024	1,033	1,042	1,059	1,064	1,057	1,042	1,029	1,012
Alternative A	1,010	1,006	1,011	1,024	1,033	1,042	1,059	1,064	1,057	1,042	1,030	1,014
Difference	2	3	0	0	0	0	0	0	0	1	1	3
Percent Difference (%)	0.2	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.3
Above Normal (15%)												
No Project/No Action Alternative	1,004	1,001	1,009	1,010	1,023	1,045	1,062	1,064	1,051	1,030	1,015	1,008
Alternative A	1,008	1,004	1,009	1,010	1,022	1,045	1,061	1,064	1,052	1,031	1,018	1,013
Difference	4	4	0	0	-1	0	-1	-1	1	2	3	5
Percent Difference (%)	0.4	0.4	0.0	0.0	-0.1	0.0	-0.1	-0.1	0.1	0.2	0.3	0.5

[a]Based on the 82-year simulation period.
[b]Relative difference of the monthly average.
[c]As defined by the Sacramento Valley 40-30-30 Index Water Year Hydrologic Classification (SWRCB, 1999).

Table 9-10
Trinity Lake End of Month Elevation, Long-Term Average, and Average by Water Year Type for Alternative A when Compared to Existing Conditions

Analysis Period	End of Month Elevation (Feet)											
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Long-Term												
Full Simulation Period[a]												
Percent Difference (%)[b]	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Water Year Types[c]												
Wet (32%)												
Percent Difference (%)	0.0	0.1	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Above Normal (15%)												
Percent Difference (%)	0.2	0.2	0.2	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.1	0.2

[a]Based on the 82-year simulation period.
[b]Relative difference of the monthly average.
[c]As defined by the Sacramento Valley 40-30-30 Index Water Year Hydrologic Classification (SWRCB, 1999).

Table 9-11
Trinity Lake End of Month Elevation, Long-Term Average, and Average by Water Year Type for Alternative A when Compared to the No Project/No Action Alternative

Analysis Period	End of Month Elevation (Feet)											
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Long-Term												
Full Simulation Period[a]												
Percent Difference (%)[b]	0.3	0.3	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.2	0.2	0.2
Water Year Types[c]												
Wet (32%)												
Percent Difference (%)	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Above Normal (15%)												
Percent Difference (%)	0.2	0.2	0.2	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2

[a]Based on the 82-year simulation period.
[b]Relative difference of the monthly average.
[c]As defined by the Sacramento Valley 40-30-30 Index Water Year Hydrologic Classification (SWRCB, 1999).

Table 9-12
Lake Oroville End of Month Elevation, Long-term Average, and Average by Water Year Type for Alternative A when Compared to Existing Conditions

Average Type	End of Month Elevation (Feet)											
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Long-Term												
Full Simulation Period[a]												
Percent Difference (%)[b]	0.0	0.0	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.2	0.0	-0.3
Water Year Types[c]												
Wet (32%)												
Percent Difference (%)	-0.9	-0.7	-0.3	-0.1	0.0	0.0	0.0	0.0	-0.1	-0.3	-0.6	-1.0
Above Normal (15%)												
Percent Difference (%)	-0.4	-0.5	0.0	0.2	0.2	0.0	0.0	0.0	-0.2	-0.4	-0.4	-0.6

[a]Based on the 82-year simulation period.
[b]Relative difference of the monthly average.
[c]As defined by the Sacramento Valley 40-30-30 Index Water Year Hydrologic Classification (SWRCB, 1999).

Table 9-13
Lake Oroville End of Month Elevation, Long-term Average, and Average by Water Year Type for Alternative A when Compared to the No Project/No Action Alternative

Average Type	End of Month Elevation (Feet)											
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Long-Term												
Full Simulation Period[a]												
Percent Difference (%)[b]	0.5	0.5	0.7	0.6	0.5	0.4	0.4	0.4	0.4	0.4	0.4	0.3
Water Year Types[c]												
Wet (32%)												
Percent Difference (%)	0.1	0.1	0.3	0.1	0.0	0.0	0.0	0.0	-0.1	-0.1	-0.1	-0.1
Above Normal (15%)												
Percent Difference (%)	0.1	0.0	0.5	0.4	0.3	0.0	0.0	0.0	-0.2	-0.2	0.0	-0.1

[a]Based on the 82-year simulation period.
[b]Relative difference of the monthly average.
[c]As defined by the Sacramento Valley 40-30-30 Index Water Year Hydrologic Classification (SWRCB, 1999).

Table 9-14
Folsom Lake End of Month Elevation, Long-Term Average, and Average by Water Year Type for Alternative A when Compared to Existing Conditions

Average Type	End of Month Elevation (Feet)											
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Long-Term												
Full Simulation Period[a]												
Percent Difference (%)[b]	0.2	0.4	0.2	0.2	0.3	0.3	0.1	0.0	0.0	0.4	0.2	0.3
Water Year Types[c]												
Wet (32%)												
Percent Difference (%)	0.1	0.3	0.2	0.0	0.1	0.0	0.0	-0.1	-0.1	0.1	0.0	0.5
Above Normal (15%)												
Percent Difference (%)	0.2	0.4	0.1	0.1	0.2	0.2	0.0	0.0	-0.1	0.5	-0.1	0.4

[a]Based on the 82-year simulation period.
[b]Relative difference of the monthly average.
[c]As defined by the Sacramento Valley 40-30-30 Index Water Year Hydrologic Classification (SWRCB, 1999).

Table 9-15
Folsom Lake End of Month Elevation, Long-Term Average, and Average by Water Year Type for Alternative A when Compared to the No Project/No Action Alternative

Average Type	End of Month Elevation (Feet)											
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Long-Term												
Full Simulation Period[a]												
Percent Difference (%)[b]	0.7	0.7	0.5	0.4	0.3	0.2	0.2	0.1	0.2	0.9	0.7	0.7
Water Year Types[c]												
Wet (32%)												
Percent Difference (%)	0.4	0.4	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.2	0.7
Above Normal (15%)												
Percent Difference (%)	0.7	0.8	0.5	0.2	0.1	0.0	0.0	0.0	0.1	0.8	0.6	0.8

[a]Based on the 82-year simulation period.
[b]Relative difference of the monthly average.
[c]As defined by the Sacramento Valley 40-30-30 Index Water Year Hydrologic Classification (SWRCB, 1999).

9.3.6.3 Primary Study Area – Alternative A

Construction, Operation, and Maintenance Impacts

Sites Reservoir Inundation Area and Sites Reservoir Dams

Most reservoirs are designed as “on-stream” reservoirs. On-stream reservoirs are sited to directly dam up an active river channel or in a location where they would receive most of their inflow by capturing natural runoff. By comparison, off-stream reservoirs are not designed to dam up a natural river course and are not sited in a location where they receive the majority of their inflow naturally. Instead, off-stream reservoirs receive their inflow primarily via human-made diversions and are sited in ideal locations where they can store much-needed water for flexible distribution. Examples of California off-stream reservoirs are the SWP-CVP jointly-used San Luis Reservoir, Contra Costa Water District’s Los Vaqueros Reservoir, and Metropolitan Water District’s Eastside Reservoir (Diamond Valley Lake).

Sites Reservoir is also designed as an off-stream storage facility. Sites Reservoir would receive very little natural runoff from its 83-square mile watershed. Average annual natural inflow into the reservoir would be approximately 15,000 acre-feet which is little more than 1 percent of the Alternative A designed 1.27-MAF reservoir storage capacity. By comparison, the average annual inflow for Lake Oroville is approximately 4.2 MAF, or approximately 120 percent of Lake Oroville’s approximately 3.5-MAF storage capacity. Sites Reservoir would be filled predominantly by diversions directly or indirectly from the Sacramento River using existing or new conveyances. Construction of the 1.27-MAF reservoir includes building two main dams and seven saddle dams. The crest elevation of all dams would be 500 feet, providing 20 feet of freeboard above the maximum operating level of 480 feet. The designed emergency spillway elevation would be at 486.5 feet.

Impact Flood-1: Substantially alter the Existing Drainage Pattern of the Site or Project Area, Including through the Alteration of the Course of a Stream or River, or Substantially Increase the Rate or Amount of Surface Runoff in a Manner which would Result in Flooding On- or Off-site

Flows from Funks and Stone Corral creeks would be impounded and diverted during the construction of Golden Gate and Sites dams. Diversion of Funks and Stone Corral creeks would likely be accomplished by passing storm flows through buried corrugated metal pipe or concrete pipe around the construction areas.

During Project construction, a cofferdam would be installed upstream of the Sites and Golden Gate dams around the dams’ construction work areas to retain storm flows entering the reservoir basin from Funks Creek and Stone Corral Creek and thereby keep the dam construction work area dry. These cofferdams would be designed to retain anticipated creek runoff in the reservoir basin during the construction period. During the construction period, storm flows would collect within the proposed reservoir basin behind the cofferdam and be released incrementally through a bypass around the Sites Dam area and discharged downstream. Storm flows would be managed during dam construction so as not to increase the downstream flood potential, resulting in a **less-than-significant impact** when compared to Existing Conditions and the No Project/No Action Alternative. Post-construction, Sites and Golden Gate dams would continue to alter existing flows on Funks and Stone Corral creeks; most water would be released through the reservoir inlet/outlet works. Thus, operation of Sites and Golden Gate dams would result in a **significant impact** due to alteration of a river or stream course, when compared to Existing Conditions and the No Project/No Action Alternative.

Operation of Sites Reservoir would decrease the magnitude of the 100-year peak flow event on Funks and Stone Corral creeks downstream of the dams by having the capacity to contain flood flows and control the release of water downstream. With implementation of Alternative A, of the 22,200 acres of land prone to flooding downstream of the proposed Sites and Golden Gate dam locations, approximately 21 percent (4,660 acres) would experience a reduction in flood-related damages. In addition to increasing the level of protection in the Funks Creek and Stone Corral Creek watersheds, a 100-year level of protection would be achieved for approximately 4,025 acres in the Colusa Basin. Based on a 100-year flood event, the flood risk would be reduced for a total of 8,685 acres (Reclamation, 2012). Therefore, operation of Sites Reservoir would result in a **potentially beneficial effect** by reducing the amount and rate of surface water runoff that has historically flooded areas downstream of the dams, when compared to Existing Conditions and the No Project/No Action Alternative.

Maintenance activities associated with the reservoir (e.g., law enforcement and garbage removal) and dams (equipment, foundation, and embankment inspections and repairs; debris and vegetation removal) would not alter existing drainage patterns or the course of a stream and would, therefore, have **no impact**, when compared to Existing Conditions and the No Project/No Action Alternative.

Impact Flood-2: Place within a 100-year Flood Hazard Area Structures which Could Impede or Redirect Flood Flows

Both Golden Gate and Sites dams would be located within 100-year flood hazard areas associated with Funks and Stone Corral creeks. Neither dam would impede or redirect flood flows in a manner that would increase potential downstream flood impacts. In contrast, both creeks would be impounded and diverted in a controlled manner during the construction of the dams, and operation of the dams would help to alleviate potential downstream flood flows on these creeks by capturing watershed runoff. Therefore, construction and operation of both dams would result in a **potentially beneficial effect** on 100-year flood flows downstream of the dam, when compared to Existing Conditions and the No Project/No Action Alternative.

Maintenance activities associated with the dams, including equipment, foundation, and embankment inspections and repairs would not impede or redirect flood flows and would, therefore, have **no impact**, when compared to Existing Conditions and the No Project/No Action Alternative.

Impact Flood-3: Expose People or Structures to a Significant Risk of Loss, Injury, or Death from Flooding, Including Flooding as a Result of the Failure of a Levee or Dam

DWR has prepared a potential dam break inundation map that reflects the inundation scenario associated with the future facility (Figure 9-5). The flood wave that would result from a hypothetical breach of Golden Gate Dam or Sites Dam has a small probability of occurring, but would present a significant hazard to both occupied and non-occupied structures downstream of Sites Reservoir. The peak outflow from a breach of Sites Reservoir is estimated at 2,078,000 cfs. The flood wave would flow east following the natural streambeds and would fan out to the relatively flat terrain of the Sacramento Valley before reaching the City of Maxwell and I-5. The estimated flow velocity at Maxwell and I-5 would be 4.5 feet per second and the maximum depth would be 10 feet. The flood wave would then continue approximately 13 miles east to the City of Colusa and the Sacramento River. The flood wave would then be impeded by the west levee of the Sacramento River. The flood would reach a depth of 22 feet (upslope of the Sacramento River levee) (DWR, 2005).

However, the Sites Reservoir dams would be designed and constructed pursuant to conservative guidelines and criteria designed to prevent failure. The designs would incorporate multiple lines of defense or design redundancy as required to meet both DWR's Division of Safety of Dams (DSOD) and Reclamation design standards. For example, the dam would be designed to withstand the largest and strongest earthquake (Maximum Credible Earthquake) as well as the largest possible flood (Probable Maximum Flood). These design standards would protect the dam from seismic or other catastrophic failure.

In addition, operation of Golden Gate and Sites dams would be monitored by instrumentation measuring such parameters as seepage, settlement, and earthquake-induced accelerations, which could provide early warning signs of potential dam failure. With modern design criteria, construction practices, and post-construction monitoring, the probability of dam failure and subsequent impacts is extremely small. Therefore, Sites Reservoir and Dams would result in a **less-than-significant impact** on the risk of loss, injury, or death due to flooding caused by dam failure, when compared to Existing Conditions and the No Project/No Action Alternative.

Both DSOD and Reclamation dam safety guidelines establish criteria for handling the emergency evacuation of a reservoir and the design of related facilities, such as the Sites Dam emergency spillway and outlet structure, required to handle the evacuation flows. Although the NODOS Feasibility Study follows DSOD design standards, DSOD's emergency evacuation criteria are actually more conservative than Reclamation's evacuation criteria. Thus, Sites Dam and the associated facilities required to handle the emergency evacuation flows would meet both DSOD and Reclamation standards (Reclamation, 2012; Reclamation, 1990).

Based on DSOD guidelines, Sites Reservoir would include an emergency spillway to release flows with an elevation set to the potential PMF water surface elevation. The proposed emergency spillway design is a simple "morning glory" intake and outflow pipe structure located in Saddle Dam 6, which would allow for overflow spill if the water surface reaches the PMF elevation. However, as an offstream reservoir, Sites Reservoir would be filled by Project-controlled diversions and would receive little inflow from the local creeks. Generally, Sites Reservoir would fill to its highest operating levels by spring to early summer, and then the levels would be drawn down during summer for water supply uses. By the time of the rainy season, when a 100-year flood is generally anticipated, the reservoir would have more than enough capacity to handle large storm events from the local creeks, even at full operating capacity.

In addition, both DSOD and Reclamation require that large reservoirs, such as Sites Reservoir, have facilities capable of allowing rapid emergency drawdown of the water in the reservoir in the event of an unsafe condition at the dam. DSOD emergency drawdown (or "evacuation") guidelines for a large reservoir require that the dam facilities have the capability to lower the reservoir level by an amount equal to 10 percent of the hydraulic head[2] behind the dam in 10 days, and to evacuate the entire reservoir in 120 days. Sites Reservoir would accomplish this drawdown via the outlet tunnel in the inlet/outlet structure, which could discharge emergency release flows directly into Funks Creek; some of this drawdown could be attenuated by Holthouse Reservoir or released via the Delevan Pipeline, the T-C Canal, or the GCID Canal. The currently designed maximum discharge rate is 23,000 cfs, which exceeds the required 10-day average discharge rate. However, the risk of an event requiring such an emergency release remains very small. Because the probability of the emergency release event occurring is so remote, Sites Reservoir and Dams would have a

[2]The hydraulic head is the difference between the normal maximum water surface elevation and the dead pool (i.e., the water level below which water can no longer be discharged) elevation

less-than-significant impact on the risk of loss, injury, or death due to flooding caused by emergency reservoir releases, when compared to Existing Conditions and the No Project/No Action Alternative.

Sites Pumping/Generating Plant, Tunnel, Sites Reservoir Inlet/Outlet Structure, Sites Electrical Switchyard, and Field Office Maintenance Yard

Impact Flood-1: Substantially alter the Existing Drainage Pattern of the Site or Project Area, Including through the Alteration of the Course of a Stream or River, or Substantially Increase the Rate or Amount of Surface Runoff in a Manner which would Result in Flooding On- or Off-site

The Sites Pumping/Generating Plant, Tunnel, Electrical Switchyard, and Field Office Maintenance Yard would not be located directly on the Funks Creek channel alignment. Therefore, construction activities associated with these facilities would not alter existing drainage patterns or alter the course of Funks Creek. Post-construction, the footprint for these proposed facilities is not expected to substantially alter the existing drainage patterns in that area. In addition, the new impervious areas associated with these facilities would not be large enough to cause a significant increase in surface runoff. Maintenance activities, including washing and cleaning of equipment, inspections, and fence maintenance, would not alter drainage patterns or stream courses. Therefore, construction, operation, and maintenance of these facilities would result in a **less-than-significant impact** on existing drainage patterns, stream courses, or surface runoff, when compared to Existing Conditions and the No Project/No Action Alternative.

Most of the footprint of the Sites Reservoir Inlet/Outlet Structure would not be located directly on the Funks Creek channel alignment. However, the footprint of the outlet approach channel to Holthouse Reservoir would cross the Funks Creek channel and would permanently remove approximately 0.5 mile of Funks Creek immediately upstream of the existing Funks Reservoir. During construction, Funks Creek would be diverted. During operation, Funks Creek would flow into the approach channel upstream of the existing Funks Reservoir. Although slight alteration of the course of the creek would occur, it would not result in flooding because diverted flows would be controlled during construction, and upstream flows would be controlled by releases from Sites Reservoir during operation. Maintenance activities, such as inspections, would not alter drainage patterns or stream courses. Therefore, construction, operation, and maintenance of the inlet/outlet structure would result in a **less-than-significant impact** on existing drainage patterns, stream courses, or surface runoff, when compared to Existing Conditions and the No Project/No Action Alternative.

Impact Flood-2: Place within a 100-year Flood Hazard Area Structures which Could Impede or Redirect Flood Flows

The proposed Sites Pumping/Generating Plant, Tunnel, Reservoir Inlet/Outlet Structure, Electrical Switchyard, and Field Office Maintenance Yard would be constructed within the 100-year flood hazard area associated with Funks Creek. However, during construction, the flows from Funks Creek would be controlled with a diversion system. During operation, Sites Reservoir would substantially reduce flood flows associated with Funks Creek by capturing runoff from a large portion of the upstream watershed. The maintenance activities would not place structures within a flood hazard area. Therefore, these facilities are not expected to significantly impede or redirect 100-year flood flows. Construction, operation, and maintenance of these facilities would result in a **less-than-significant impact** on 100-year flood flows, when compared to Existing Conditions and the No Project/No Action Alternative.

Impact Flood-3: Expose People or Structures to a Significant Risk of Loss, Injury, or Death from Flooding, Including Flooding as a Result of the Failure of a Levee or Dam

No dams or levees are associated with these proposed Project facilities. Therefore, construction, operation, and maintenance of these facilities would result in **no impact** due to increased flood risks, including potential flooding due a levee or dam failure, when compared to Existing Conditions and the No Project/No Action Alternative.

Recreation Areas

Impact Flood-1: Substantially alter the Existing Drainage Pattern of the Site or Project Area, Including through the Alteration of the Course of a Stream or River, or Substantially Increase the Rate or Amount of Surface Runoff in a Manner which would Result in Flooding On- or Off-site

The proposed Recreation Areas would encompass a total of approximately 1,205 acres, which is less than two square miles. Assuming the two square miles were completely covered by new impervious surface areas, such as asphalt parking lots, this would still account for only approximately 2 percent of the 83-square-mile Sites Reservoir watershed drainage area, which is too small to cause a significant difference in runoff from the runoff that currently occurs in that area (Reclamation, 2012). Therefore, construction, operation, and maintenance of the proposed Recreation Areas would not substantially alter the existing drainage patterns or a stream or river course, nor substantially increase surface runoff, resulting in a **less-than-significant impact**, when compared to Existing Conditions and the No Project/No Action Alternative.

Impact Flood-2: Place within a 100-year Flood Hazard Area Structures which Could Impede or Redirect Flood Flows

If Alternative A is implemented, the proposed Recreation Areas would not be developed within a 100-year flood hazard area. Therefore, their construction, operation, and maintenance would result in **no impact** on 100-year flood flows, when compared to Existing Conditions and the No Project/No Action Alternative.

Impact Flood-3: Expose People or Structures to a Significant Risk of Loss, Injury, or Death from Flooding, Including Flooding as a Result of the Failure of a Levee or Dam

If Alternative A is implemented, there would be no dams or levees associated with the proposed Recreation Areas. Therefore, construction, operation, and maintenance of the proposed Recreation Areas would result in **no impact** due to increased flood risks, including potential flooding due to a levee or dam failure, when compared to Existing Conditions and the No Project/No Action Alternative.

Road Relocations and South Bridge

Impact Flood-1: Substantially alter the Existing Drainage Pattern of the Site or Project Area, Including through the Alteration of the Course of a Stream or River, or Substantially Increase the Rate or Amount of Surface Runoff in a Manner which would Result in Flooding On- or Off-site

If Alternative A is implemented, construction activities would include the relocation of portions of the existing Maxwell Sites Road and Sites Lodoga Road, and construction of the South Bridge across Sites Reservoir. This road relocation alignment, which includes the new South Bridge crossing, would be paved during construction and maintained as such during operation, but would not add significant new paved road area relative to the existing roadway alignment. In addition, this road relocation alignment would not cross any streams, and therefore, would not alter the course of a stream during construction or operation.

The temporary construction roads and additional permanent access roads, such as those to the proposed recreation areas and Project facilities, would be constructed and operated as unpaved (gravel) roads, and in turn, would not significantly contribute to surface runoff. In addition, these roads would not cross any streams, and therefore, would not alter the course of a stream during construction or operation. The only exception would be the proposed Eastside Road, which would be paved for approximately four miles at its southern end, and would cross Funks Creek approximately 0.4 mile downstream of the proposed Golden Gate Dam. The portion of the road that would be paved during construction and maintained as such during operation would not add significant new paved road area. The Funks Creek crossing would require the installation of a culvert; this activity would occur during the period that the creek is diverted. Although slight alteration of the course of the creek would occur during diversion, it would not result in flooding because bypass flows would be controlled during construction, and the course of the stream would be restored prior to operation. During operation, upstream flows would be controlled by releases from Sites Reservoir.

Road maintenance activities, such as chip sealing, patching, grading, vegetation control, and repair of damaged guardrails or fencing, and minor bridge or culvert maintenance, would consist of debris removal, and would not alter existing drainage patterns or alter the course of a stream. Therefore, construction, operation, and maintenance of the road relocations, new South Bridge, and new access roads combined would not substantially alter existing drainage patterns or stream courses and would not increase surface runoff, resulting in a **less-than-significant impact** on existing drainage patterns, stream courses, or surface runoff, when compared to Existing Conditions and the No Project/No Action Alternative.

Impact Flood-2: Place within a 100-year Flood Hazard Area Structures which Could Impede or Redirect Flood Flows

If Alternative A is implemented, the northeast end of the proposed Sulphur Gap Road, where it would connect with the existing Maxwell Sites Road, would be constructed within a portion of Stone Corral Creek's 100-year flood hazard area. However, only a small portion of flood hazard area would be affected by the proposed roadway during construction, and during operation, Sites Reservoir would substantially reduce flood flows associated with Stone Corral Creek by capturing runoff from a large portion of the upstream watershed. Road maintenance activities would not place additional structures within the flood hazard area. Therefore, construction, operation, and maintenance of the proposed road would result in a **less-than-significant impact** on 100-year flood flows, when compared to Existing Conditions and the No Project/No Action Alternative.

Impact Flood-3: Expose People or Structures to a Significant Risk of Loss, Injury, or Death from Flooding, Including Flooding as a Result of the Failure of a Levee or Dam

If Alternative A is implemented, there would be no dams or levees associated with the proposed Road Relocations and South Bridge. Therefore, the construction, operation, and maintenance of the Road Relocations and the South Bridge would result in **no impact** due to increased flood risks including potential flooding due a levee or dam failure, when compared to Existing Conditions and the No Project/No Action Alternative.

Glenn-Colusa Irrigation District Canal Facilities Modifications

Impact Flood-1: Substantially alter the Existing Drainage Pattern of the Site or Project Area, Including through the Alteration of the Course of a Stream or River, or Substantially Increase the Rate or Amount of Surface Runoff in a Manner which would Result in Flooding On- or Off-site

The proposed GCID Canal Facilities modifications (including the new headgate structure, 200 feet of canal lining, and railroad siphon replacement) would not drastically alter the existing canal structure. In addition, operation and maintenance activities are expected to be similar to those of the existing canal. Construction, operation, and maintenance activities associated with the GCID Canal Facilities modifications would not alter the course of a natural stream or river and would not substantially alter existing drainage patterns or increase runoff. Therefore, construction, operation, and maintenance of the proposed GCID Canal Facilities modifications would result in a **less-than-significant impact** on existing drainage patterns, stream courses, or surface runoff, when compared to Existing Conditions and the No Project/No Action Alternative.

Impact Flood-2: Place within a 100-year Flood Hazard Area Structures which Could Impede or Redirect Flood Flows

Most of the existing GCID Canal does not pass through a 100-year flood hazard area except for the north end, which passes through a 100-year flood hazard area associated with primarily Colusa Basin Drain flows. However, the proposed GCID Canal Facilities modifications that would occur during Project construction would be made to the existing canal and thus would not further impede or redirect 100-year flood flows more than the existing canal. In addition, operation and maintenance activities would be similar to those performed at the existing canal. Therefore, construction, operation, and maintenance of the proposed GCID Canal Facilities modifications would result in a **less-than-significant impact** on 100-year flood flows, when compared to Existing Conditions and the No Project/No Action Alternative.

Impact Flood-3: Expose People or Structures to a Significant Risk of Loss, Injury, or Death from Flooding, Including Flooding as a Result of the Failure of a Levee or Dam

The existing GCID Canal Facilities are located on a non-leveed bypass channel that diverts Sacramento River flows. Because no levees or dams are associated with the GCID Canal Facilities, construction, operation, and maintenance the proposed modifications would have no impact on levees or dams, and therefore, no associated potential flood risk impacts due to levee or dam failure. Therefore, construction, operation, and maintenance of the proposed GCID Canal Facilities modifications would result in **no impact** due to increased flood risks, including potential flooding due a levee or dam failure, when compared to Existing Conditions and the No Project/No Action Alternative.

Holthouse Reservoir Complex and Holthouse Reservoir Electrical Switchyard

Preliminary feasibility studies indicate that Holthouse Reservoir would need an active storage of approximately 6,500 acre-feet (approximately three times larger than the existing Funks Reservoir storage), covering a surface area of 530 acres (approximately 2.3 times larger than the existing Funks Reservoir surface area) and with maximum dam embankment heights of 45 feet above existing grade (Reclamation, 2012).

Impact Flood-1: Substantially alter the Existing Drainage Pattern of the Site or Project Area, Including through the Alteration of the Course of a Stream or River, or Substantially Increase the Rate or Amount of Surface Runoff in a Manner which would Result in Flooding On- or Off-site

Dredging of the existing Funks Reservoir, as well as the construction of the Holthouse Reservoir Complex and Holthouse Reservoir Electrical Switchyard, would require the diversion of Funks Creek. Although alteration of the course of the creek would occur, it would not result in flooding because bypass flows would be controlled during construction.

The proposed Funks Reservoir enlargement that would result from construction of the adjacent Holthouse Reservoir would not be a large enough increase to substantially alter drainage patterns around the existing Funks Reservoir. In addition, during operation, the upstream Sites Reservoir would substantially reduce flood flows associated with Funks Creek by capturing runoff from a large portion of the upstream watershed. Operation and maintenance activities associated with the enlarged Holthouse Reservoir Complex are expected to be similar to those of the existing Funks Reservoir and would not increase the risk of flooding from existing conditions in the area. Maintenance of the existing Funks Reservoir would include road, vegetation, and fence maintenance, and debris removal. Funks Reservoir is also drained annually. These maintenance activities are expected to be the same for Holthouse Reservoir. Maintenance of the electrical switchyard may include annual washing and cleaning of insulating equipment, and landscape maintenance; these activities would not affect drainage patterns. Therefore, construction, operation, and maintenance of the Holthouse Reservoir Complex and Holthouse Reservoir Electrical Switchyard, and dredging of the existing Funks Reservoir, would result in a **less-than-significant impact** on existing drainage patterns, stream courses, or surface runoff, when compared to Existing Conditions and the No Project/No Action Alternative.

Impact Flood-2: Place within a 100-year Flood Hazard Area Structures which Could Impede or Redirect Flood Flows

Funks Reservoir is an existing structure; an evaluation of **Impact Flood-2** is therefore not applicable to that Project feature. The Holthouse Reservoir Complex and Holthouse Reservoir Electrical Switchyard would be constructed within a Special Flood Hazard Area associated with Funks Creek 100-year flood flows. However, during construction, the flows from Funks Creek would be controlled with a diversion system. During operation, the larger Holthouse Reservoir would likely not impede 100-year flood flows more so than the existing Funks Reservoir, which is located within the same Special Flood Hazard Area. The four-acre Holthouse Reservoir Electrical Switchyard would have a gravel base, and would not be expected to significantly impede 100-year flood flows. In addition, operation of Sites Reservoir would substantially reduce flood flows associated with Funks Creek by capturing runoff from a large portion of the upstream watershed. Maintenance activities are expected to be similar to those of the existing Funks Reservoir for Holthouse Reservoir, and would involve washing and vegetation control for the electrical switchyard; these activities would not place additional structures within the Special Flood Hazard Area.

Therefore, construction, operation, and maintenance of the Holthouse Reservoir Complex and Holthouse Reservoir Electrical Switchyard would result in a **less-than-significant impact** on 100-year flood flows, when compared to Existing Conditions and the No Project/No Action Alternative.

Impact Flood-3: Expose People or Structures to a Significant Risk of Loss, Injury, or Death from Flooding, Including Flooding as a Result of the Failure of a Levee or Dam

As designed, the 6,500-acre-foot Holthouse Reservoir, which is an expansion of the existing Funks Reservoir, would be a jurisdictional reservoir[3]. For jurisdictional reservoirs, DSOD oversees the dam design and permitting processes and usually requires a dam break analysis as part of the design and permitting process. The reservoir design is not detailed enough at this stage for a quantitative analysis. However, Holthouse Dam would be designed and constructed pursuant to the same conservative guidelines and criteria designed to prevent failure as described for Sites Reservoir. These design standards would protect the dam from seismic or other failure, and would, therefore, result in a **less-than-significant impact** on the risk of loss, injury, or death due to flooding caused by dam failure, when compared to Existing Conditions and the No Project/No Action Alternative. Holthouse Reservoir would also be constructed with a maximum emergency spillway discharge capacity of 23,000 cfs to pass the equivalent Sites Reservoir emergency drawdown flows required by DSOD, which would be discharged directly into Funks Creek via the inlet/outlet works (Reclamation, 2012). Some of this emergency drawdown could also be attenuated by the TRR, or could be released via the Delevan Pipeline, the T-C Canal, or the GCID Canal. However, the risk of an event requiring such an emergency release remains very small. Because the probability of the emergency release event occurring is so remote, the Holthouse Reservoir Complex would have a **less-than-significant impact** on the risk of loss, injury, or death due to flooding caused by emergency reservoir releases, when compared to Existing Conditions and the No Project/No Action Alternative.

Maintenance activities associated with Holthouse Reservoir are expected to be similar to those of the existing Funks Reservoir and would not be expected to exposed people to increased flood risks. Therefore, maintenance of the Holthouse Reservoir Complex would result in a **less-than-significant impact** on the exposure of people to increased flood risks, including potential flooding due to a levee or dam failure, when compared to Existing Conditions and the No Project/No Action Alternative.

Terminal Regulating Reservoir, Terminal Regulating Reservoir Pumping/Generating Plant, Terminal Regulating Reservoir Electrical Switchyard, Glenn-Colusa Irrigation District Canal Connection to the Terminal Regulating Reservoir, Terminal Regulating Reservoir Pipeline, and Terminal Regulating Reservoir Pipeline Road

Impact Flood-1: Substantially alter the Existing Drainage Pattern of the Site or Project Area, Including through the Alteration of the Course of a Stream or River, or Substantially Increase the Rate or Amount of Surface Runoff in a Manner which would Result in Flooding On- or Off-site

The portion of these TRR facilities that would be constructed and operated above ground would not be located near a stream and do not have a large enough footprint to substantially alter existing drainage patterns. In addition, operation of the upstream Sites Reservoir would substantially reduce flood flows in this area associated with Funks Creek by capturing runoff from a large portion of the upstream watershed, as well as by limiting post-construction flows to Funks Creek downstream of Golden Gate Dam.

Maintenance activities, such as vegetation clearing and necessary repairs to the TRR Pipeline Road, would not substantially affect runoff in the area. However, the draining and dredging of the reservoir,

---

[3] A Jurisdictional Reservoir is a reservoir for which DSOD has design and construction permitting jurisdiction. A main threshold for DSOD jurisdiction is a minimum six foot height requirement.

which would occur every seven to 10 years depending on sediment accumulation, would require releases from the reservoir to Funks Creek via the TRR to Funks Creek Pipeline. Although these releases would increase creek flows, releases would be controlled with an energy dissipater and small concrete structure at the terminal end of the pipeline to avoid exceeding the capacity of the creek channel. Therefore, construction, operation, and maintenance of these TRR facilities would result in a **less-than-significant impact** on existing drainage patterns, stream courses, or surface runoff, when compared to Existing Conditions and the No Project/No Action Alternative.

Impact Flood-2: Place within a 100-year Flood Hazard Area Structures which Could Impede or Redirect Flood Flows

The TRR, TRR Pumping/Generating Plant, TRR Electrical Switchyard, GCID Canal Connection to the TRR, and TRR Pipeline Road would be constructed and operated within a 100-year flood hazard area associated with Funks Creek. These above-ground structures may impede 100-year flood flows; however, Sites Reservoir would substantially reduce these 100-year flood flows associated with Funks Creek by capturing runoff from a large portion of the upstream watershed. Maintenance activities associated with these facilities would not place additional structures within the flood hazard area. Therefore, construction, operation and maintenance of these TRR facilities would result in a **less-than-significant impact** on 100-year flood flows, when compared to Existing Conditions and the No Project/No Action Alternative.

The TRR Pipeline and TRR to Funks Creek Pipeline would both be constructed within a 100-year flood hazard area associated with Funks Creek. Both pipelines would be buried a minimum of 10 feet (to top of pipe) below the ground surface. The only above-ground features associated with both pipelines would be blow off and air valves, each of which would occupy a small area of land. Once installed, surface grading would be restored above the pipelines such that operation of these pipelines would not significantly impede or redirect flood flows or increase flooding hazards in other areas. The pipelines would thus not impede 100-year flood flows. Therefore, construction, operation and maintenance of the TRR Pipeline and the TRR to Funks Creek Pipeline would result in a **less-than-significant impact** on 100-year flood flows, when compared to Existing Conditions and the No Project/No Action Alternative.

Impact Flood-3: Expose People or Structures to a Significant Risk of Loss, Injury, or Death from Flooding, Including Flooding as a Result of the Failure of a Levee or Dam

Because of safety factors that are built into current engineering design practices, the probability of dam failure, in general, is extremely small. The TRR is expected to be considered jurisdictional by DSOD because the preliminary designed embankment height would be greater than six feet. A dam break analysis has not yet been performed, but the TRR would be designed and constructed pursuant to the same conservative guidelines and criteria designed to prevent failure as described for Sites Reservoir. These design standards would protect the dam from seismic or other failure, and would, therefore, result in a **less-than-significant impact** on the risk of loss, injury, or death due to flooding caused by dam failure, when compared to Existing Conditions and the No Project/No Action Alternative.

Reservoir design would allow emergency releases during operation first to the GCID Canal, and then to Funks Creek via the TRR to Funks Creek Pipeline. Although these releases would increase creek flows, releases would be controlled with an energy dissipater and small concrete structure at the terminal end of the pipeline to avoid exceeding the capacity of the creek channel. In addition, the risk of an event requiring such an emergency release remains very small. Therefore, the TRR facilities would result in a

less-than-significant impact on existing drainage patterns, stream courses, or surface runoff, when compared to Existing Conditions and the No Project/No Action Alternative.

Delevan Transmission Line

Impact Flood-1: Substantially alter the Existing Drainage Pattern of the Site or Project Area, Including through the Alteration of the Course of a Stream or River, or Substantially Increase the Rate or Amount of Surface Runoff in a Manner which would Result in Flooding On- or Off-site

The Delevan Transmission Line would be operated as an entirely above-ground Project facility, except for its tower footings. Construction of the required footings for the 13-mile-long transmission line would create a total permanent ground disturbance of approximately 2.5 acres. However, given that the footings would not be a continuous strip of concrete (i.e., they would be spaced apart), this land area disturbance would not significantly alter the existing drainage area or runoff patterns of the transmission alignment area. In addition, tower footings would be sited to avoid stream crossings, and therefore, would not alter the course of a stream. Maintenance activities, including equipment inspections and vegetation maintenance, would not alter drainage patterns or alter the course of a stream. Therefore, construction, operation, and maintenance of the Delevan Transmission Line would result in a **less-than-significant impact** on existing drainage patterns, stream courses, or surface runoff, when compared to Existing Conditions and the No Project/No Action Alternative.

Impact Flood-2: Place within a 100-year Flood Hazard Area Structures which Could Impede or Redirect Flood Flows

Approximately half of the length of the above-ground Delevan Transmission Line would be located within the northern portion of a designated 100-year flood hazard area associated with primarily Colusa Basin Drain flows. Although the transmission line would be operated as an entirely above-ground facility, the construction of the required transmission line footings for the entire 13-mile length of the transmission line would create a total ground disturbance of approximately 2.5 acres. Approximately half of these footings would be located within a flood hazard area. However, the footings would be spaced apart, and their individual small footprint would not significantly impede 100-year flood flows. Maintenance activities would not place additional structures within the flood hazard area. Therefore, construction, operation, and maintenance of the Delevan Transmission Line would result in a **less-than-significant impact** on 100-year flood flows, when compared to Existing Conditions and the No Project/No Action Alternative.

Impact Flood-3: Expose People or Structures to a Significant Risk of Loss, Injury, or Death from Flooding, Including Flooding as a Result of the Failure of a Levee or Dam

No dams or levees are associated with the Delevan Transmission Line. Therefore, construction, operation, and maintenance of the Delevan Transmission Line would result in **no impact** due to increased flooding risks, including potential flooding due a levee or dam failure, when compared to Existing Conditions and the No Project/No Action Alternative.

Delevan Pipeline Electrical Switchyard

Impact Flood-1: Substantially alter the Existing Drainage Pattern of the Site or Project Area, Including through the Alteration of the Course of a Stream or River, or Substantially Increase the Rate or Amount of Surface Runoff in a Manner which would Result in Flooding On- or Off-site

The Delevan Pipeline Electrical Switchyard would not be located directly on the Funks Creek channel alignment. Therefore, construction activities would not alter existing drainage patterns or alter the course of Funks Creek. During operation, the four-acre ground surface of the switchyard would have a gravel base and would not be expected to significantly alter the existing drainage area or runoff patterns of that area. Maintenance activities, including equipment washing and vegetation maintenance, would not alter drainage patterns or alter the course of a stream. Therefore, construction, operation, and maintenance of the Delevan Pipeline Electrical Switchyard would result in a **less-than-significant impact** on existing drainage patterns, stream courses, or surface runoff, when compared to Existing Conditions and the No Project/No Action Alternative.

Impact Flood-2: Place within a 100-year Flood Hazard Area Structures which Could Impede or Redirect Flood Flows

The Delevan Pipeline Electrical Switchyard would be constructed within a designated 100-year flood hazard area associated with Funks Creek. However, during construction, the flows from Funks Creek would be controlled with a diversion system. During operation, the four-acre switchyard would have a gravel base, and would not be expected to significantly impede 100-year flood flows. In addition, operation of Sites Reservoir would substantially reduce flood flows associated with Funks Creek by capturing runoff from a large portion of the upstream watershed. Maintenance activities would not place additional structures within the flood hazard area. Therefore, construction, operation, and maintenance of the Delevan Pipeline Electrical Switchyard would result in a **less-than-significant impact** on 100-year flood flows, when compared to Existing Conditions and the No Project/No Action Alternative.

Impact Flood-3: Expose People or Structures to a Significant Risk of Loss, Injury, or Death from Flooding, Including Flooding as a Result of the Failure of a Levee or Dam

No dams or levees are associated with the Delevan Pipeline Electrical Switchyard. Therefore, construction, operation, and maintenance of the Delevan Pipeline Electrical Switchyard would result in **no impact** due to increased flooding risks, including potential flooding due a levee or dam failure, when compared to Existing Conditions and the No Project/No Action Alternative.

Delevan Pipeline

Impact Flood-1: Substantially alter the Existing Drainage Pattern of the Site or Project Area, Including through the Alteration of the Course of a Stream or River, or Substantially Increase the Rate or Amount of Surface Runoff in a Manner which would Result in Flooding On- or Off-site

The Delevan Pipeline would be constructed as an underground facility, generally buried 10 feet below the ground surface. The pipeline would cross the Colusa Basin Drain at the northern end of the drain. Construction at this crossing would likely occur during late fall after the irrigation season ends and before winter rains begin. Despite the timing, a portion of the CBD would likely need to be dewatered, with any existing flows bypassed around the construction site. This construction at the crossing would be accomplished by installing the pipeline in stages and bypassing flows on one side of the channel following the construction of a cofferdam. The slight alteration of the course of this waterway would not substantially alter drainage patterns. After installation of the pipeline, the CBD would be returned to a full channel and would be reconstructed to pre-project conditions. Once installed, surface grading would be restored above the pipeline such that it would not significantly alter the existing area drainage pattern. The only above-ground components associated with the operation of the Delevan Pipeline would be manholes and blow off and air valves, each of which would occupy a small area of land, and would, therefore, not impede or redirect flood flows. Maintenance activities, including periodic inspections, would not affect drainage patterns or runoff. Therefore, construction, operation, and maintenance of the Delevan Pipeline would result in a less-than-significant impact on existing drainage patterns, stream courses, or surface runoff, when compared to Existing Conditions and the No Project/No Action Alternative.

Impact Flood-2: Place within a 100-year Flood Hazard Area Structures which Could Impede or Redirect Flood Flows

The Delevan Pipeline would cross the northern portion of a designated 100-year flood hazard area associated with Funks Creek and Colusa Basin Drain flows. However, the Delevan Pipeline would be constructed as an underground facility, and therefore, would not impede or redirect flows.

Once the pipeline is installed, surface grading would be restored above the pipeline such that it would not significantly impede or redirect flood flows or increase flooding hazards in other areas. The only above-ground components associated with operation of the Delevan Pipeline would be manholes and blow off and air valves, each of which would occupy a small area of land. These above-ground components would not impede 100-year flood flows. In addition, Sites Reservoir would substantially reduce flood flows associated with Funks Creek by capturing runoff from a large portion of the upstream watershed. Maintenance activities would not place additional structures within the flood hazard area. Therefore, construction, operation, and maintenance of the Delevan Pipeline would result in a **less-than-significant impact** on 100-year flood flows, when compared to Existing Conditions and the No Project/No Action Alternative.

Impact Flood-3: Expose People or Structures to a Significant Risk of Loss, Injury, or Death from Flooding, Including Flooding as a Result of the Failure of a Levee or Dam

No dams or levees are associated with the Delevan Pipeline. Therefore, construction, operation, and maintenance of the Delevan Pipeline would result in **no impact** due to increased flooding risks, including potential flooding due a levee or dam failure, when compared to Existing Conditions and the No Project/No Action Alternative.

Delevan Pipeline Intake Facilities

Impact Flood-1: Substantially alter the Existing Drainage Pattern of the Site or Project Area, Including through the Alteration of the Course of a Stream or River, or Substantially Increase the Rate or Amount of Surface Runoff in a Manner which would Result in Flooding On- or Off-site

The proposed Delevan Pipeline Intake Facilities would be constructed adjacent to the Sacramento River, where an existing flood protection levee separates the river from upland areas. The proposed footprint would not cover an area large enough to substantially alter existing drainage patterns or increase surface runoff. During construction and operation, the facility would be surrounded by a wide berm or ring levee that would have impacts on drainage patterns and surface runoff similar to those of the existing levee, and therefore, would not increase the risk of flooding. The proposed intake would require the construction of a large fish screen, which would be located on the west side of the river channel immediately downstream of the Maxwell ID Pumping Plant. During construction, a sheet-pile cofferdam that would extend approximately 40 feet into the river channel would be required to allow dewatering of the construction area. The cofferdam would be removed when construction is complete, but the operating fish screen would continue to extend into the river channel. In-channel structures have the potential to alter the course of the river. However, the preliminary fish screen was designed so as to not protrude into the river channel in a manner that would substantially alter the river channel. In addition, the upstream Maxwell ID Pumping Plant is located in a narrow section of the river and consequently acts as a local flow control point (Reclamation, 2012). Maintenance of the facilities would not alter drainage patterns or affect surface runoff.

Therefore, construction, operation, and maintenance of the Delevan Pipeline Intake Facilities would result in a **less-than-significant impact** on existing drainage patterns, stream courses, or surface runoff, when compared to Existing Conditions and the No Project/No Action Alternative.

Impact Flood-2: Place within a 100-year Flood Hazard Area Structures which Could Impede or Redirect Flood Flows

The Delevan Pipeline Intake Facilities would be located adjacent to the Sacramento River within an area protected from the 100-year flood by existing levees along the Sacramento River. The Project includes improvements to the levee in the area of the intake to enhance the flood protection for this facility. An earthen setback levee (or ring levee around the site) would be installed for protection during construction and would remain a permanent structure to provide secondary containment of the Sacramento River in the event of a flood in the area. These above-ground structures would not impede 100-year flood flows during operation.

In addition, preliminary analysis shows that the proposed fish screen would not substantially impact the water surface elevation at high flows. Water surface elevations with the proposed fish screen are not expected to be significantly different than without the fish screen. The existing Maxwell ID Pumping Plant upstream from the proposed intake location would be the controlling structure, causing greater changes on Sacramento River water surface elevations at high flows than the proposed Delevan Pipeline Intake Facilities (Reclamation, 2012). Maintenance activities would not place additional structures within a flood hazard area. Therefore, construction, operation, and maintenance of the Delevan Pipeline Intake Facilities would result in a **less-than-significant impact** on 100-year flood flows, when compared to Existing Conditions and the No Project/No Action Alternative.

Impact Flood-3: Expose People or Structures to a Significant Risk of Loss, Injury, or Death from Flooding, Including Flooding as a Result of the Failure of a Levee or Dam

Construction of the Delevan Pipeline Intake Facilities would require modification of the existing flood protection levee along the Sacramento River. Construction work along the existing levee has the potential to destabilize adjacent levee segments and, under worst-case conditions, cause their failure. DWR's and Reclamation's construction contractor would use standard geotechnical engineering practices related to the stabilization and compaction of soils during and after work around the levee for the Delevan Pipeline Intake Facilities to ensure that the integrity of the levee is not compromised. Such practices include soil densification of foundation soils to improve their stabilization and reduce potential liquefaction. Construction plans, specifications, and inspections would be coordinated with the CVFPB, as appropriate. It is unlikely that these facilities would significantly change the degree of protection of people and property behind the levee or result in an increased risk of levee failure.

Operation of the intake facilities would require the construction and operation of a forebay and afterbay. The forebay would be located on the river side of the existing Sacramento River levee, and would pass water to the concrete-lined afterbay through levee tubes that would pass under the existing levee. A new berm or ring levee would be constructed to enclose the afterbay. The remaining facilities would be constructed and operated on top of the berm. During extreme flood events on the river, the forebay and afterbay would be inundated, but these facilities and the levees would be designed to withstand these conditions. Maintenance activities would include the removal of sediment from the afterbay sediment spoil area. Sediment would be removed using a long arm excavator and suction dredge from within the afterbay and would not affect the levees. Therefore, construction, operation, and maintenance of the Delevan Pipeline Intake Facilities would result in a **less-than-significant impact** due to increased flooding risks, including potential flooding due a levee or dam failure, when compared to Existing Conditions and the No Project/No Action Alternative.

Project Buffer

Impact Flood-1: Substantially alter the Existing Drainage Pattern of the Site or Project Area, Including through the Alteration of the Course of a Stream or River, or Substantially Increase the Rate or Amount of Surface Runoff in a Manner which would Result in Flooding On- or Off-site

If Alternative A is implemented, construction-related activities within the Project Buffer would include fence construction, demolition of several existing structures, and the creation of a fuelbreak. Ground disturbance associated with fence construction would consist of digging post holes. The existing structures to be demolished within the Project Buffer would include residences, sheds, shops, and barns. A fuelbreak would be created around the perimeter of the buffer. Fence construction, structure demolition, and the creation of a fuelbreak would not alter the course of a stream, and would not increase the rate of runoff in a manner that would result in flooding because the footprint of the fence posts and structures, as well as the area of the fuelbreak, represent a fraction of the acreage included in the Project Buffer. Therefore, construction activities within the Project Buffer would result in a **less-than-significant impact** on existing drainage patterns, stream courses, or surface runoff within the Primary Study Area, when compared to Existing Conditions and the No Project/No Action Alternative.

Post-construction, Project operations and maintenance activities for the new fence and the fuelbreak within the Project Buffer would result in a **less-than-significant impact** on existing drainage patterns, stream courses, or surface runoff, when compared to Existing Conditions and the No Project/No Action Alternative, because the land would be managed as undeveloped open space that would buffer Project facilities from surrounding land uses.

Impact Flood-2: Place within a 100-year Flood Hazard Area Structures which Could Impede or Redirect Flood Flows

If Alternative A is implemented, the only new structures that would be installed within the Project Buffer would be fence posts. Fence construction, or the presence of the fence posts during operation, would not impede or redirect flood flows because the footprint of the fence posts represents a fraction of the acreage included in the Project Buffer. Maintenance activities would not place additional structures within the Project Buffer. Therefore, construction, operation, and maintenance of the Proposed Take Line would result in **no impact** to 100-year flood flows, when compared to Existing Conditions and the No Project/No Action Alternative.

Impact Flood-3: Expose People or Structures to a Significant Risk of Loss, Injury, or Death from Flooding, Including Flooding as a Result of the Failure of a Levee* o*r Dam

If Alternative A is implemented, no dams or levees would be needed for the land acquisition or demarcation of the Project Buffer, and the Project Buffer would have no effect on an existing levee or dam. Therefore, construction, operation, and maintenance of the Project Buffer would result in **no impact** due to increased flooding risks, including potential flooding due a levee or dam failure, when compared to Existing Conditions and the No Project/No Action Alternative.

9.3.7 Impacts Associated with Alternative B

9.3.7.1 Extended Study Area – Alternative B

Construction, Operation, and Maintenance Impacts

The impacts associated with Alternative B, as they relate to drainage patterns, stream courses, or surface runoff (**Impact Flood-1**), 100-year flood flows (**Impact Flood-2**), and flooding risks (**Impact Flood-3**), would be the same as described for Alternative A for the Extended Study Area.

9.3.7.2 Secondary Study Area – Alternative B

Construction, Operation, and Maintenance Impacts

Impacts due to the construction, operation, and maintenance of Alternative B, as they relate to drainage patterns, stream courses, or surface runoff (**Impact Flood-1)** and 100-year flood flows (**Impact Flood-2**) within the Secondary Study Area, would be the same as described for Alternative A. However, operational changes resulting from coordination with a 1.81-MAF Sites Reservoir with two conveyances for Alternative B, as opposed to the 1.27-MAF Sites Reservoir with three conveyances for Alternative A, have the potential to impact flood control reservoirs in the Secondary Study Area. The difference in average end of month elevation at the Secondary Study Area flood control reservoirs is described below.

Trinity Lake, Lewiston Lake, Trinity River, Klamath River Downstream of the Trinity River, Whiskeytown Lake, Spring Creek, Shasta Lake, Sacramento River, Keswick Reservoir, Clear Creek, Lake Oroville, Thermalito Complex (Thermalito Diversion Pool, Thermalito Forebay, and Thermalito Afterbay), Feather River, Sutter Bypass, Yolo Bypass, Folsom Lake, Lake Natoma, American River, Sacramento-San Joaquin Delta, Suisun Bay, San Pablo Bay, San Francisco Bay

Impact Flood-3: Expose People or Structures to a Significant Risk of Loss, Injury, or Death from Flooding, Including Flooding as a Result of the Failure of a Levee or Dam

Impacts due to the construction and maintenance of Alternative B due to increased flooding risks within the Secondary Study Area would be similar to those described for Alternative A.

Tables 9-16 through 9-23 indicate potential minor operational impacts to several flood control reservoirs in the Secondary Study Area. Table 9-16 provides the average Shasta Lake end of the month water surface elevation for Alternative B when compared to Existing Conditions over the long-term and by water year type. The Above Normal and Wet year types are shown because flooding is most likely to occur during these water year types. Long-term average changes to the water surface elevation would range from a 0.0 to 0.5 percent increase. Changes expected for Above Normal and Wet years would be less, at -0.1 to 0.1 percent and -0.2 to 0.1 percent, respectively.

Table 9-16
Shasta Lake End of Month Elevation, Long-Term Average, and Average by Water Year Type for Alternative B when Compared to Existing Conditions

Analysis Period	End of Month Elevation (Feet)											
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Long-Term												
Full Simulation Period[a]												
Existing Conditions	980	979	987	1,001	1,015	1,030	1,041	1,042	1,030	1,008	993	984
Alternative B	985	984	991	1,003	1,015	1,031	1,044	1,046	1,034	1,014	998	990
Difference	5	5	3	2	0	1	2	3	4	5	5	5
Percent Difference (%)[b]	0.5	0.5	0.3	0.2	0.0	0.1	0.2	0.3	0.4	0.5	0.5	0.5
Water Year Types[c]												
Wet (32%)												
Existing Conditions	1,009	1,004	1,010	1,024	1,033	1,042	1,059	1,064	1,057	1,042	1,029	1,013
Alternative B	1,009	1,005	1,010	1,024	1,033	1,042	1,059	1,065	1,058	1,042	1,029	1,014
Difference	0	1	-1	0	-1	0	0	0	0	0	0	0
Percent Difference (%)	0.0	0.1	-0.1	0.0	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Above Normal (15%)												
Existing Conditions	1,006	1,002	1,010	1,011	1,024	1,046	1,062	1,064	1,052	1,030	1,016	1,010
Alternative B	1,007	1,003	1,008	1,010	1,022	1,045	1,062	1,064	1,053	1,031	1,017	1,011
Difference	1	1	-2	-1	-2	-1	0	0	1	1	1	1
Percent Difference (%)	0.1	0.1	-0.2	-0.1	-0.2	-0.1	0.0	0.0	0.1	0.1	0.1	0.1

[a]Based on the 82-year simulation period.
[b]Relative difference of the monthly average.
[c]As defined by the Sacramento Valley 40-30-30 Index Water Year Hydrologic Classification (SWRCB, 1999).

Table 9-17 shows the same Shasta Lake information for Alternative B, when compared to the No Project/No Action Alternative. Long-term average changes would range from 0.0 to 0.5 percent increases. Wet year changes would range from -0.1 to 0.1 percent, and Above Normal year changes would range from -0.2 to 0.1 percent.

Modeling results indicate similar impacts at Trinity, Oroville, and Folsom reservoirs (Tables 9-18 through 9-23). Therefore, when compared to Existing Conditions and the No Project/No Action Alternative, construction, operation and maintenance of Alternative B would result in a **less-than-significant impact** due to increased flooding risks, including potential flooding due a levee or dam failure.

Table 9-17
Shasta Lake End of Month Elevation, Long-Term Average, and Average by Water Year Type for Alternative B when Compared to the No Project/No Action Alternative

Analysis Period	End of Month Elevation (Feet)											
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Long-Term												
Full Simulation Period[a]												
No Project/No Action Alternative	980	980	988	1,002	1,015	1,030	1,042	1,042	1,029	1,008	992	984
Alternative B	985	984	991	1,003	1,015	1,031	1,044	1,046	1,034	1,014	998	990
Difference	5	5	3	2	0	1	2	3	4	5	5	6

Table 9-17
Shasta Lake End of Month Elevation, Long-Term Average, and Average by Water Year Type for Alternative B when Compared to the No Project/No Action Alternative

Analysis Period	End of Month Elevation (Feet)											
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Percent Difference (%)[b]	0.6	0.5	0.3	0.2	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.6
Water Year Types[c]												
Wet (32%)												
No Project/No Action Alternative	1,008	1,003	1,010	1,024	1,033	1,042	1,059	1,064	1,057	1,042	1,029	1,012
Alternative B	1,009	1,005	1,010	1,024	1,033	1,042	1,059	1,065	1,058	1,042	1,029	1,014
Difference	1	1	-1	0	-1	0	0	0	0	0	1	2
Percent Difference (%)	0.1	0.1	-0.1	0.0	-0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.2
Above Normal (15%)												
No Project/No Action Alternative	1,004	1,001	1,009	1,010	1,023	1,045	1,062	1,064	1,051	1,030	1,015	1,008
Alternative B	1,007	1,003	1,008	1,010	1,022	1,045	1,062	1,064	1,053	1,031	1,017	1,011
Difference	3	2	-1	0	-2	0	0	0	1	2	2	3
Percent Difference (%)	0.3	0.2	-0.1	0.0	-0.2	0.0	0.0	0.0	0.1	0.1	0.2	0.3

[a]Based on the 82-year simulation period.
[b]Relative difference of the monthly average.
[c]As defined by the Sacramento Valley 40-30-30 Index Water Year Hydrologic Classification (SWRCB, 1999).

Table 9-18
Trinity Lake End of Month Elevation, Long-Term Average, and Average by Water Year Type for Alternative B when Compared to Existing Conditions

Average Type	End of Month Elevation (Feet)											
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Long-Term												
Full Simulation Period[a]												
Percent Difference (%)[b]	0.2	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Water Year Types[c]												
Wet (32%)												
Percent Difference (%)	0.0	0.0	0.0	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Above Normal (15%)												
Percent Difference (%)	0.2	0.2	0.2	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2

[a]Based on the 82-year simulation period.
[b]Relative difference of the monthly average.
[c]As defined by the Sacramento Valley 40-30-30 Index Water Year Hydrologic Classification (SWRCB, 1999).

Table 9-19
Trinity Lake End of Month Elevation, Long-Term Average, and Average by Water Year Type for Alternative B when Compared to the No Project/No Action Alternative

Average Type	End of Month Elevation (Feet)											
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Long-Term												
Full Simulation Period[a]												
Percent Difference (%)[b]	0.3	0.3	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.2	0.2	0.2
Water Year Types[c]												
Wet (32%)												
Percent Difference (%)	0.1	0.1	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Above Normal (15%)												
Percent Difference (%)	0.2	0.3	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.3

[a]Based on the 82-year simulation period.
[b]Relative difference of the monthly average.
[c]As defined by the Sacramento Valley 40-30-30 Index Water Year Hydrologic Classification (SWRCB, 1999).

Table 9-20
Lake Oroville End of Month Elevation, Long-Term Average, and Average by Water Year Type for Alternative B when Compared to Existing Conditions

Average Type	End of Month Elevation (Feet)											
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Long-Term												
Full Simulation Period[a]												
Percent Difference (%)[b]	-0.2	-0.1	0.0	0.1	0.1	0.1	0.2	0.2	0.2	0.3	0.1	-0.4
Water Year Types[c]												
Wet (32%)												
Percent Difference (%)	-0.9	-0.8	-0.3	-0.2	-0.1	0.0	0.0	0.0	-0.1	-0.2	-0.6	-1.1
Above Normal (15%)												
Percent Difference (%)	-0.7	-0.8	-0.3	0.1	0.1	0.0	0.0	0.0	-0.2	-0.3	-0.6	-0.9

[a]Based on the 82-year simulation period.
[b]Relative difference of the monthly average.
[c]As defined by the Sacramento Valley 40-30-30 Index Water Year Hydrologic Classification (SWRCB, 1999).

Table 9-21
Lake Oroville End of Month Elevation, Long-Term Average, and Average by Water Year Type for Alternative B when Compared to the No Project/No Action Alternative

Average Type	End of Month Elevation (Feet)											
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Long-Term												
Full Simulation Period[a]												
Percent Difference (%)[b]	0.4	0.4	0.5	0.4	0.4	0.3	0.3	0.4	0.4	0.6	0.5	0.3
Water Year Types[c]												
Wet (32%)												
Percent Difference (%)	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	-0.1	-0.1
Above Normal (15%)												
Percent Difference (%)	-0.3	-0.3	0.2	0.3	0.2	0.1	0.1	0.0	-0.2	-0.2	-0.1	-0.4

[a]Based on the 82-year simulation period.
[b]Relative difference of the monthly average.
[c]As defined by the Sacramento Valley 40-30-30 Index Water Year Hydrologic Classification (SWRCB, 1999).

Table 9-22
Folsom Lake End of Month Elevation, Long-Term Average, and Average by Water Year Type for Alternative B when Compared to Existing Conditions

Average Type	End of Month Elevation (Feet)											
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Long-Term												
Full Simulation Period[a]												
Percent Difference (%)[b]	0.1	0.2	0.1	0.1	0.2	0.2	0.0	-0.1	-0.1	0.1	0.0	0.4
Water Year Types[c]												
Wet (32%)												
Percent Difference (%)	0.0	0.0	0.0	0.0	0.1	0.0	0.0	-0.1	-0.1	-0.1	-0.2	0.4
Above Normal (15%)												
Percent Difference (%)	0.0	0.1	-0.1	0.0	0.1	0.2	0.0	0.0	-0.2	-0.1	-0.5	0.0

[a]Based on the 82-year simulation period.
[b]Relative difference of the monthly average.
[c]As defined by the Sacramento Valley 40-30-30 Index Water Year Hydrologic Classification (SWRCB, 1999).

Table 9-23
Folsom Lake End of Month Elevation, Long-Term Average, and Average by Water Year Type for Alternative B when Compared to the No Project/No Action Alternative

Average Type	End of Month Elevation (Feet)											
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Long-Term												
Full Simulation Period[a]												
Percent Difference (%)[b]	0.6	0.6	0.4	0.2	0.2	0.1	0.1	0.0	0.1	0.6	0.5	0.8
Water Year Types[c]												
Wet (32%)												
Percent Difference (%)	0.2	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.6
Above Normal (15%)												
Percent Difference (%)	0.5	0.6	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.4

[a]Based on the 82-year simulation period.
[b]Relative difference of the monthly average.
[c]As defined by the Sacramento Valley 40-30-30 Index Water Year Hydrologic Classification (SWRCB, 1999).

9.3.7.3 Primary Study Area – Alternative B

Construction, Operation, and Maintenance Impacts

The following Project facilities are included in both Alternatives A and B. These facilities would require the same construction methods and operation and maintenance activities regardless of alternative, and would, therefore, result in the same construction, operation, and maintenance impacts to flood control and management:

- Recreation Areas
- Sites Pumping/Generating Plant
- Sites Electrical Switchyard
- Tunnel from Sites Pumping/Generating Plant to Sites Reservoir Inlet/Outlet Structure
- Sites Reservoir Inlet/Outlet Structure
- Field Office Maintenance Yard
- Holthouse Reservoir Complex

- Holthouse Reservoir Electrical Switchyard
- GCID Canal Facilities Modifications
- GCID Canal Connection to the TRR
- TRR
- TRR Pumping/Generating Plant
- TRR Electrical Switchyard
- TRR Pipeline
- TRR Pipeline Road
- Delevan Pipeline
- Delevan Pipeline Electrical Switchyard

The proposed 1.81-MAF Sites Reservoir associated with implementation of Alternative B would require the construction of two main dams and nine saddle dams. The crest elevation of all dams would be 540 feet, providing 20 feet of freeboard above the maximum operating elevation of 520 feet. The emergency spillway elevation would be at 525.5 feet. The larger reservoir would be constructed pursuant to the same conservative guidelines and criteria designed to prevent failure as described for Alternative A. The larger Alternative B reservoir and associated dams would capture flood flows on Funks and Stone Corral creeks and control downstream releases to these creeks as described for Alternative A, and therefore, would have the same impacts on drainage patterns, stream courses, or surface runoff (**Impact Flood-1**), 100-year flood flows (**Impact Flood-2**), and flooding risks (**Impact Flood-3**) as described for Alternative A.

The additional saddle dams associated with implementation of Alternative B would require additional saddle dam access roads. However, the slight extension of the saddle dam access roads would result in the same impacts on drainage patterns, stream courses, or surface runoff (**Impact Flood-1**), 100-year flood flows (**Impact Flood-2**), and flooding risks (**Impact Flood-3**) as described for Alternative A.

If Alternative B is implemented, the proposed Delevan Transmission Line would extend from only the Inlet/Outlet Structure to the existing PG&E or WAPA transmission line and consequently would not cross the Special Flood Hazard Area. The shorter transmission line would require fewer concrete footings, thus creating a smaller land disturbance footprint than the Alternative A transmission line configuration. These reduced effects would result in the same level of significance of impacts to drainage patterns, stream courses, or surface runoff (**Impact Flood-1**), 100-year flood flows (**Impact Flood-2**), and flooding risks (**Impact Flood-3**) as was described for Alternative A.

The Delevan Pipeline Intake Facilities would be replaced with the smaller Delevan Pipeline Discharge Facility, which would not extend into the river channel, and therefore, would not alter the course of a stream. The Discharge Facility would require similar levee modifications as the Intake Facilities. The smaller footprint would have similar impacts on drainage patterns, stream courses, or surface runoff (**Impact Flood-1**), 100-year flood flows (**Impact Flood-2**), and flooding risks (**Impact Flood-3)** as was described for Alternative A.

The boundary of the Project Buffer would be the same for Alternatives A and B, but because the footprints of some of the Project facilities that are surrounded by the Project Buffer would differ between the alternatives, the acreage of land within the Project Buffer would also differ. However, this difference in the size of the buffer would not change the type of construction, operation, and maintenance activities that were described for Alternative A. It would, therefore, have the same impact on drainage patterns, stream courses, or surface runoff (**Impact Flood-1**), 100-year flood flows (**Impact Flood-2**), and flooding risks (**Impact Flood-3)** as was described for Alternative A.

9.3.8 Impacts Associated with Alternative C

9.3.8.1 Extended Study Area – Alternative C

Construction, Operation, and Maintenance Impacts

The impact of Alternative C on drainage patterns, stream courses, or surface runoff (**Impact Flood-1**), 100-year flood flows (**Impact Flood-2**), and flooding risks (**Impact Flood-3)** would be the same as described for Alternative A for the Extended Study Area.

9.3.8.2 Secondary Study Area – Alternative C

Construction, Operation, and Maintenance Impacts

The impact of Alternative C on drainage patterns, stream courses, or surface runoff (**Impact Flood-1**) and 100-year flood flows (**Impact Flood-2**) within the Secondary Study Area would be the same as described for Alternative A. However, operational changes resulting from coordination with a 1.81-MAF Sites Reservoir with three conveyances for Alternative C, as opposed to the 1.27-MAF Sites Reservoir with three conveyances for Alternative A, have the potential to impact flood control reservoirs in the Secondary Study Area. The difference in average end of month elevation at the Secondary Study Area flood control reservoirs is described below.

Trinity Lake, Lewiston Lake, Trinity River, Klamath River Downstream of the Trinity River, Whiskeytown Lake, Spring Creek, Shasta Lake, Sacramento River, Keswick Reservoir, Clear Creek, Lake Oroville, Thermalito Complex (Thermalito Diversion Pool, Thermalito Forebay, and Thermalito Afterbay), Feather River, Sutter Bypass, Yolo Bypass, Folsom Lake, Lake Natoma, American River, Sacramento-San Joaquin Delta, Suisun Bay, San Pablo Bay, San Francisco Bay

Impact Flood-3: Expose People or Structures to a Significant Risk of Loss, Injury, or Death from Flooding, Including Flooding as a Result of the Failure of a Levee or Dam

The impacts due to construction and maintenance of Alternative C within the Secondary Study Area would be similar to those described for Alternative B.

Tables 9-24 through 9-31 indicate potential minor operational impacts to several flood control reservoirs in the Secondary Study Area. Table 9-24 provides the average Shasta Lake end of the month water surface elevation for Alternative C, when compared to Existing Conditions over the long-term and by water year type. The Above Normal and Wet year types are shown because flooding is most likely to occur during these water year types. Long-term average changes to the water surface elevation in Shasta Lake would range from a 0.1 to 0.6 percent increase. Changes in Above Normal and Wet years would be even less, at -0.1 to 0.1 percent and -0.1 to 0.3 percent, respectively.

Table 9-24
Shasta Lake End of Month Elevation, Long-Term Average, and Average by Water Year Type for Alternative C when Compared to Existing Conditions

Analysis Period	End of Month Elevation (Feet)											
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Long-Term												
Full Simulation Period[a]												
Existing Conditions	980	979	987	1,001	1,015	1,030	1,041	1,042	1,030	1,008	993	984
Alternative C	986	985	992	1,004	1,016	1,032	1,044	1,046	1,034	1,014	998	990

Table 9-24
Shasta Lake End of Month Elevation, Long-Term Average, and Average by Water Year Type for Alternative C when Compared to Existing Conditions

Analysis Period	End of Month Elevation (Feet)											
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Difference	6	6	4	3	1	2	3	3	5	5	5	6
Percent Difference (%)[b]	0.6	0.6	0.4	0.3	0.1	0.2	0.2	0.3	0.5	0.5	0.5	0.6
Water Year Types[c]												
Wet (32%)												
Existing Conditions	1,009	1,004	1,010	1,024	1,033	1,042	1,059	1,064	1,057	1,042	1,029	1,013
Alternative C	1,010	1,005	1,009	1,024	1,033	1,042	1,059	1,064	1,057	1,043	1,030	1,014
Difference	1	1	-1	0	0	0	0	0	0	0	1	1
Percent Difference (%)	0.1	0.1	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1
Above Normal (15%)												
Existing Conditions	1,006	1,002	1,010	1,011	1,024	1,046	1,062	1,064	1,052	1,030	1,016	1,010
Alternative C	1,008	1,004	1,008	1,012	1,023	1,046	1,062	1,064	1,053	1,031	1,018	1,013
Difference	3	1	-1	1	-1	0	0	0	1	1	2	3
Percent Difference (%)	0.2	0.1	-0.1	0.1	-0.1	0.0	0.0	0.0	0.1	0.1	0.2	0.3

[a]Based on the 82-year simulation period.
[b]Relative difference of the monthly average.
[c]As defined by the Sacramento Valley 40-30-30 Index Water Year Hydrologic Classification (SWRCB, 1999).

Table 9-25 shows the same Shasta Lake information for Alternative C, when compared to the No Project/No Action Alternative. Long-term average changes would range from 0.1 to 0.6 percent. Wet year changes would range from -0.1 to 0.1 percent, and Above Normal year changes would range from -0.1 to 0.3 percent.

Modeling results indicate similar impacts at Trinity, Oroville, and Folsom reservoirs (Tables 9-26 through 9-31).

Therefore, when compared to Existing Conditions and the No Project/No Action Alternative, construction, operation and maintenance of Alternative C would result in a **less–than-significant impact** due to increased flooding risks, including potential flooding due a levee or dam failure.

Table 9-25
Shasta Lake End of Month Elevation, Long-Term Average, and Average by Water Year Type for Alternative C when Compared to the No Project/No Action Alternative

Analysis Period	End of Month Elevation (Feet)											
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Long-Term												
Full Simulation Period[a]												
No Project/No Action Alternative	980	980	988	1,002	1,015	1,030	1,042	1,042	1,029	1,008	992	984
Alternative C	986	985	992	1,004	1,016	1,032	1,044	1,046	1,034	1,014	998	990
Difference	6	6	4	3	1	2	2	3	5	6	6	6

Table 9-25
Shasta Lake End of Month Elevation, Long-Term Average, and Average by Water Year Type for Alternative C when Compared to the No Project/No Action Alternative

Analysis Period	End of Month Elevation (Feet)											
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Percent Difference (%)[b]	0.6	0.6	0.4	0.3	0.1	0.2	0.2	0.3	0.5	0.6	0.6	0.7
Water Year Types[c]												
Wet (32%)												
No Project/No Action Alternative	1,008	1,003	1,010	1,024	1,033	1,042	1,059	1,064	1,057	1,042	1,029	1,012
Alternative C	1,010	1,005	1,009	1,024	1,033	1,042	1,059	1,064	1,057	1,043	1,030	1,014
Difference	2	1	-1	0	-1	0	0	0	0	1	1	3
Percent Difference (%)	0.2	0.1	-0.1	0.0	-0.1	0.0	0.0	0.0	0.0	0.1	0.1	0.2
Above Normal (15%)												
No Project/No Action Alternative	1,004	1,001	1,009	1,010	1,023	1,045	1,062	1,064	1,051	1,030	1,015	1,008
Alternative C	1,008	1,004	1,008	1,012	1,023	1,046	1,062	1,064	1,053	1,031	1,018	1,013
Difference	4	3	0	2	0	0	0	0	1	2	3	5
Percent Difference (%)	0.4	0.3	0.0	0.2	0.0	0.0	0.0	0.0	0.1	0.2	0.3	0.5
Below Normal (17%)												
No Project/No Action Alternative	999	1,002	1,006	1,000	1,017	1,034	1,049	1,050	1,038	1,017	1,002	999
Alternative C	1,000	1,003	1,005	1,001	1,016	1,034	1,049	1,051	1,040	1,018	1,005	1,002
Difference	2	1	-1	0	-1	0	0	0	2	1	3	2
Percent Difference (%)	0.2	0.1	-0.1	0.0	-0.1	0.0	0.0	0.0	0.2	0.1	0.3	0.2

[a]Based on the 82-year simulation period.
[b]Relative difference of the monthly average.
[c]As defined by the Sacramento Valley 40-30-30 Index Water Year Hydrologic Classification (SWRCB, 1999).

Table 9-26
Trinity Lake End of Month Elevation, Long-Term Average, and Average by Water Year Type for Alternative C when Compared to Existing Conditions

Analysis Period and Water Year Types	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Long-Term												
Full Simulation Period[a]												
Percent Difference (%)[b]	0.3	0.4	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.3
Water Year Types[c]												
Wet (32%)												
Percent Difference (%)	0.1	0.1	0.0	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Above Normal (15%)												
Percent Difference (%)	0.2	0.3	0.3	0.5	0.4	0.3	0.3	0.3	0.3	0.3	0.3	0.3

[a]Based on the 82-year simulation period.
[b]Relative difference of the monthly average.
[c]As defined by the Sacramento Valley 40-30-30 Index Water Year Hydrologic Classification (SWRCB, 1999).

Table 9-27
Trinity Lake End of Month Elevation, Long-Term Average, and Average by Water Year Type for Alternative C when Compared to the No Project/No Action Alternative

	End of Month Elevation (Feet)											
Average Type	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**
Long-Term												
Full Simulation Period[a]												
Percent Difference (%)[b]	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.3
Water Year Types[c]												
Wet (32%)												
Percent Difference (%)	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Above Normal (15%)												
Percent Difference (%)	0.3	0.3	0.3	0.5	0.5	0.4	0.3	0.3	0.3	0.3	0.3	0.3

[a]Based on the 82-year simulation period.
[b]Relative difference of the monthly average.
[c]As defined by the Sacramento Valley 40-30-30 Index Water Year Hydrologic Classification (SWRCB, 1999).

Table 9-28
Lake Oroville End of Month Elevation, Long-Term Average, and Average by Water Year Type for Alternative C when Compared to Existing Conditions

Analysis Period and Water Year Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Full Simulation Period[a]												
Percent Difference (%)[b]	-0.2	-0.1	0.2	0.2	0.1	0.1	0.2	0.2	0.0	0.1	0.0	-0.4
Water Year Types[c]												
Wet (32%)												
Percent Difference (%)	-0.8	-0.7	-0.1	0.0	-0.1	0.0	0.0	0.0	-0.1	-0.3	-0.6	-1.0
Above Normal (15%)												
Percent Difference (%)	-0.5	-0.5	0.0	0.2	0.1	0.0	0.0	0.0	-0.3	-0.4	-0.4	-0.7

[a]Based on the 82-year simulation period.
[b]Relative difference of the monthly average.
[c]As defined by the Sacramento Valley 40-30-30 Index Water Year Hydrologic Classification (SWRCB, 1999).

Table 9-29
Lake Oroville End of Month Elevation, Long-Term Average, and Average by Water Year Type for Alternative C when Compared to the No Project/No Action Alternative

	End of Month Elevation (Feet)											
Average Type	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**
Long-Term												
Full Simulation Period[a]												
Percent Difference (%)[b]	0.4	0.4	0.6	0.5	0.4	0.3	0.3	0.3	0.3	0.4	0.4	0.2
Water Year Types[c]												
Wet (32%)												
Percent Difference (%)	0.1	0.2	0.5	0.2	0.0	0.0	0.0	0.0	-0.1	-0.1	-0.1	-0.1
Above Normal (15%)												
Percent Difference (%)	0.0	-0.1	0.5	0.4	0.2	0.0	0.0	0.0	-0.2	-0.2	0.0	-0.2

[a]Based on the 82-year simulation period.
[b]Relative difference of the monthly average.
[c]As defined by the Sacramento Valley 40-30-30 Index Water Year Hydrologic Classification (SWRCB, 1999).

Table 9-30
Folsom Lake End of Month Elevation, Long-Term Average, and Average by Water Year Type for Alternative C when Compared to Existing Conditions

Analysis Period and Water Year Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Full Simulation Period[a]												
Percent Difference (%)[b]	0.3	0.3	0.1	0.2	0.3	0.3	0.0	0.0	0.0	0.3	0.3	0.4
Water Year Types[c]												
Wet (32%)												
Percent Difference (%)	0.1	0.0	0.0	0.0	0.1	0.0	0.0	-0.1	-0.1	0.2	0.0	0.6
Above Normal (15%)												
Percent Difference (%)	0.2	0.2	-0.1	0.0	0.2	0.2	0.0	0.0	-0.1	0.1	-0.2	0.4

[a]Based on the 82-year simulation period.
[b]Relative difference of the monthly average.
[c]As defined by the Sacramento Valley 40-30-30 Index Water Year Hydrologic Classification (SWRCB, 1999).

Table 9-31
Folsom Lake End of Month Elevation, Long-Term Average, and Average by Water Year Type for Alternative C when Compared to the No Project/No Action Alternative

Average Type	End of Month Elevation (Feet)											
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Long-Term												
Full Simulation Period[a]												
Percent Difference (%)[b]	0.7	0.6	0.4	0.3	0.3	0.2	0.1	0.1	0.2	0.7	0.8	0.9
Water Year Types[c]												
Wet (32%)												
Percent Difference (%)	0.4	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.2	0.8
Above Normal (15%)												
Percent Difference (%)	0.7	0.6	0.3	0.1	0.1	0.0	0.0	0.0	0.1	0.4	0.5	0.8

[a]Based on the 82-year simulation period.
[b]Relative difference of the monthly average.
[c]As defined by the Sacramento Valley 40-30-30 Index Water Year Hydrologic Classification (SWRCB, 1999).

9.3.8.3 Primary Study Area – Alternative C

Construction, Operation, and Maintenance Impacts

The following Primary Study Area Project facilities are included in Alternatives A, B, and C. These facilities would require the same construction methods and operation and maintenance activities regardless of alternative, and would, therefore, result in the same construction, operation, and maintenance impacts to flood control and management:

- Recreation Areas
- Sites Pumping/Generating Plant
- Sites Electrical Switchyard
- Tunnel from Sites Pumping/Generating Plant to Sites Reservoir Inlet/Outlet Structure
- Sites Reservoir Inlet/Outlet Structure
- Field Office Maintenance Yard
- Holthouse Reservoir Complex
- Holthouse Reservoir Electrical Switchyard
- GCID Canal Facilities Modifications
- GCID Canal Connection to the TRR

- TRR
- TRR Pumping/Generating Plant
- TRR Electrical Switchyard
- TRR Pipeline
- TRR Pipeline Road
- Delevan Pipeline
- Delevan Pipeline Electrical Switchyard

The Alternative C design of the Delevan Transmission Line and Delevan Pipeline Intake Facilities is the same as described for Alternative A. These facilities would require the same construction methods and operation and maintenance activities regardless of alternative, and would, therefore, result in the same construction, operation, and maintenance impacts to drainage patterns, stream courses, or surface runoff (**Impact Flood-1**), 100-year flood flows (**Impact Flood-2**), and flooding risks (**Impact Flood-3)** as described for Alternative A.

The Alternative C design of the Sites Reservoir Inundation Area and Dams, Recreation Areas, and Road Relocations and South Bridge is the same as described for Alternative B. These facilities would require the same construction methods and operation and maintenance activities regardless of alternative, and would, therefore, result in the same construction, operation, and maintenance impacts to drainage patterns, stream courses, or surface runoff (**Impact Flood-1**), 100-year flood flows (**Impact Flood-2**), and flooding risks (**Impact Flood-3)** as described for Alternative B.

The boundary of the Project Buffer would be the same for all alternatives, but because the footprints of some of the Project facilities that are included in the Project Buffer would differ between the alternatives, the acreage of land within the Project Buffer would also differ. However, these differences in the size of the area included within the buffer would not change the type of construction, operation, and maintenance activities that were described for Alternative A. They would, therefore, have the same impact on drainage patterns, stream courses, or surface runoff (**Impact Flood-1**), 100-year flood flows (**Impact Flood-2**), and flooding risks (**Impact Flood-3)** as described for Alternative A.

9.4 Mitigation Measures

Mitigation measures are provided below and summarized in Table 9-32 for the impacts that have been identified as significant or potentially significant.

Table 9-32
Summary of Mitigation Measures for
NODOS Project Impacts to Flood Control and Management

Impact	Associated Project Facility	LOS Before Mitigation	Mitigation Measure	LOS After Mitigation
Impact Flood-1: Substantially Alter the Existing Drainage Pattern of the Site or Project Area, Including Through the Alteration of the Course of a Stream or River, or Substantially Increase the Rate or Amount of Surface Runoff in a Manner Which Would Result in Flooding On- or Off-site	Sites Reservoir, Sites Dams	Significant	Mitigation Measure Flood-1: Maintain Permanent Low Flow Releases into Stone Corral and Funks Creeks Downstream of Sites and Golden Gate Dams	Less than Significant

Note:
LOS = Level of Significance

Mitigation Measure Flood-1: Maintain Permanent Low Flow Releases into Stone Corral and Funks Creeks Downstream of Sites and Golden Gate Dams

To mitigate for **Impact Flood-1** and pursuant to DFG Code 5937 related to maintaining flows downstream of dams, post-construction fish flows into Funks and Stone Corral creeks shall be maintained by DWR and Reclamation by means of low-flow release valves at Golden Gate and Sites dams. Flows shall be maintained at 10 cfs from October through May in both creeks to mimic the seasonal nature of the creeks while avoiding historic flooding.

Implementation of **Mitigation Measure Flood-1** would reduce the level of significance of Project impacts to flood control and management to **less than significant**.

9.5 References

California Department of Water Resources (DWR). 2010. State Plan of Flood Control Descriptive Document.

California Department of Water Resources (DWR). 2009. State Plan of Flood Control Descriptive Document. Administrative Draft. November.

California Department of Water Resources (DWR). 2007. Oroville Facilities Relicensing DEIR. May.

California Department of Water Resources (DWR). 2005. North of Delta Offstream Storage Investigations, Sites Reservoir Inundation Analysis.

California State Water Resources Control Board (SWRCB). 1999. Water Right Decision 1641. December.

Federal Emergency Management Agency (FEMA). 2003. Flood Insurance Study: Colusa County, California and Unincorporated Areas. pp. 4-6.

Tehama Colusa Canal Authority (TCCA). 2005. Personal communication with Jim Weathers on April 27.

U. S. Army Corps of Engineers (USACE). 1999. Sacramento and San Joaquin River Basins California: Post-Flood Assessment. pp. 3-8 to 3-22.

U.S. Bureau of Reclamation (Reclamation). 2012. North of Delta Off stream Storage Investigation Feasibility Report. Administrative Draft. June.

U.S. Bureau of Reclamation (Reclamation). 2009. Trinity River Restoration Program Draft Master EIR-EA/Draft EIR.

U.S. Bureau of Reclamation (Reclamation). 2008. Shasta Lake Water Resources Investigation. EIS/EIR. September.

U. S. Bureau of Reclamation (Reclamation). 2004. Long-Term Central Valley Project Operations Criteria and Plan.

U. S. Bureau of Reclamation (Reclamation). 1990. ACER Technical Memorandum No. 3, Criteria and Guidelines for Evacuating Storage Reservoirs and Sizing Low-Level Outlet Works, Assistant Commissioner.

U.S. Bureau of Reclamation, Contra Costa Water District, and Western Area Power Administration (Reclamation, CCWD, and WAPA). 2009. Los Vaqueros Reservoir Expansion Project. Environmental Impact Statement/Environmental Impact Report. State Clearinghouse No. 2006012037.

U.S. Bureau of Reclamation and California Department of Water Resources (Reclamation and DWR). 2005. South Delta Improvement Program.

Figures

Facilities

- Approximately 1,600 miles of levees
- Five major weirs spilling floodwaters from the Sacramento River to bypass channels
- Five control structures directing flow in bypass channels along the San Joaquin River
- Six major pumping plants
- Channel improvements
- Bank protection
- Associated facilities, such as stream gages and drainage facilities

Lands

- Fee title, easements, and agreements for project works and mitigation areas
- Approximately 18,000 parcels

Operations and Maintenance

- Two standard O&M manuals
- 118 unit-specific manuals
- Maintenance by State and local maintaining agencies

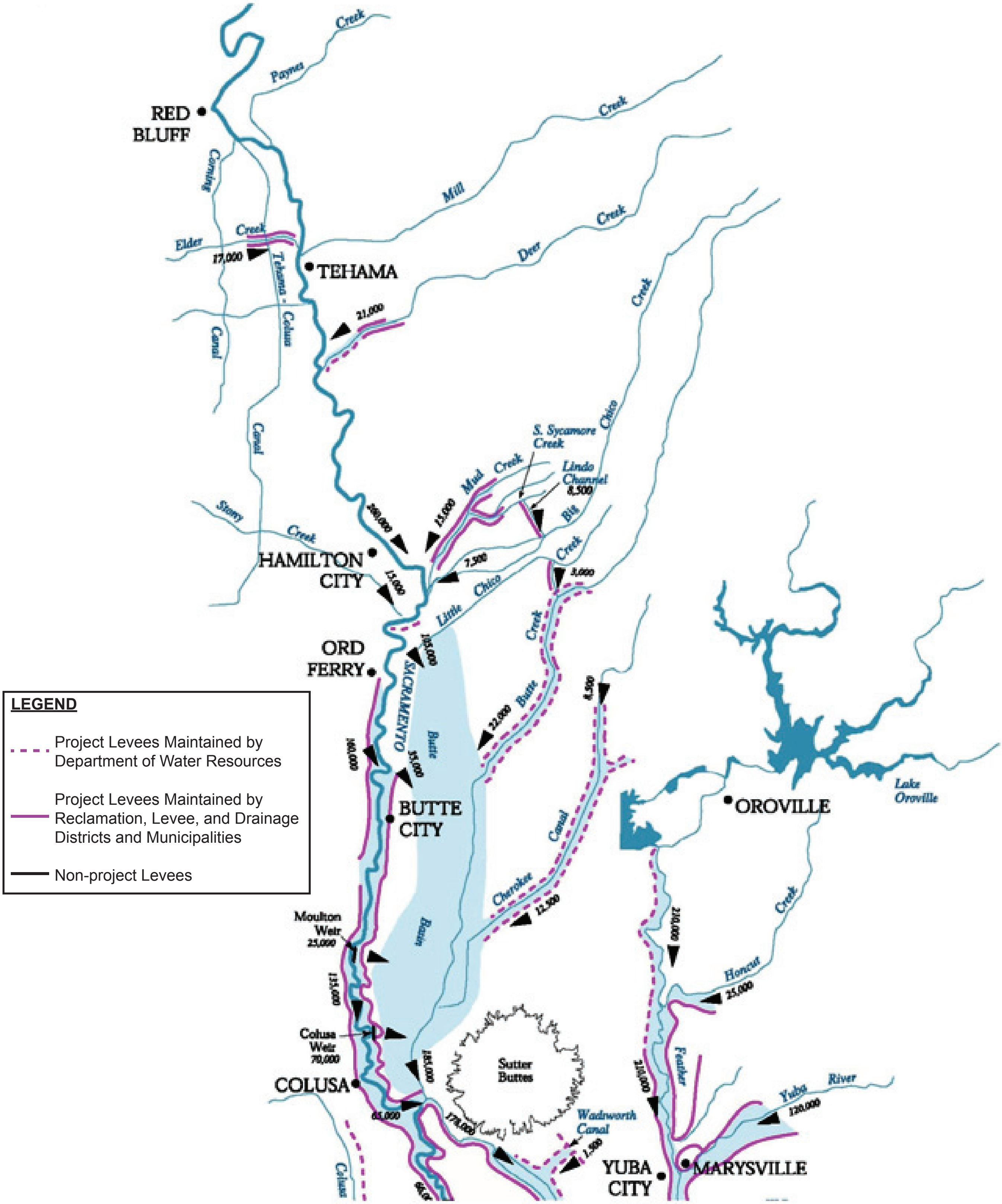
Conditions (terms)

- Assurances
- Flood Control Regulations, Part 208.10 of 33, Code of Federal Regulations
- Requirements of standard and unit-specific O&M manuals
- Design profiles (1955 and 1957)
- Project Cooperation Agreements

Programs and Plans

- Historical documents and processes
- As-constructed drawings
- Oversight and management

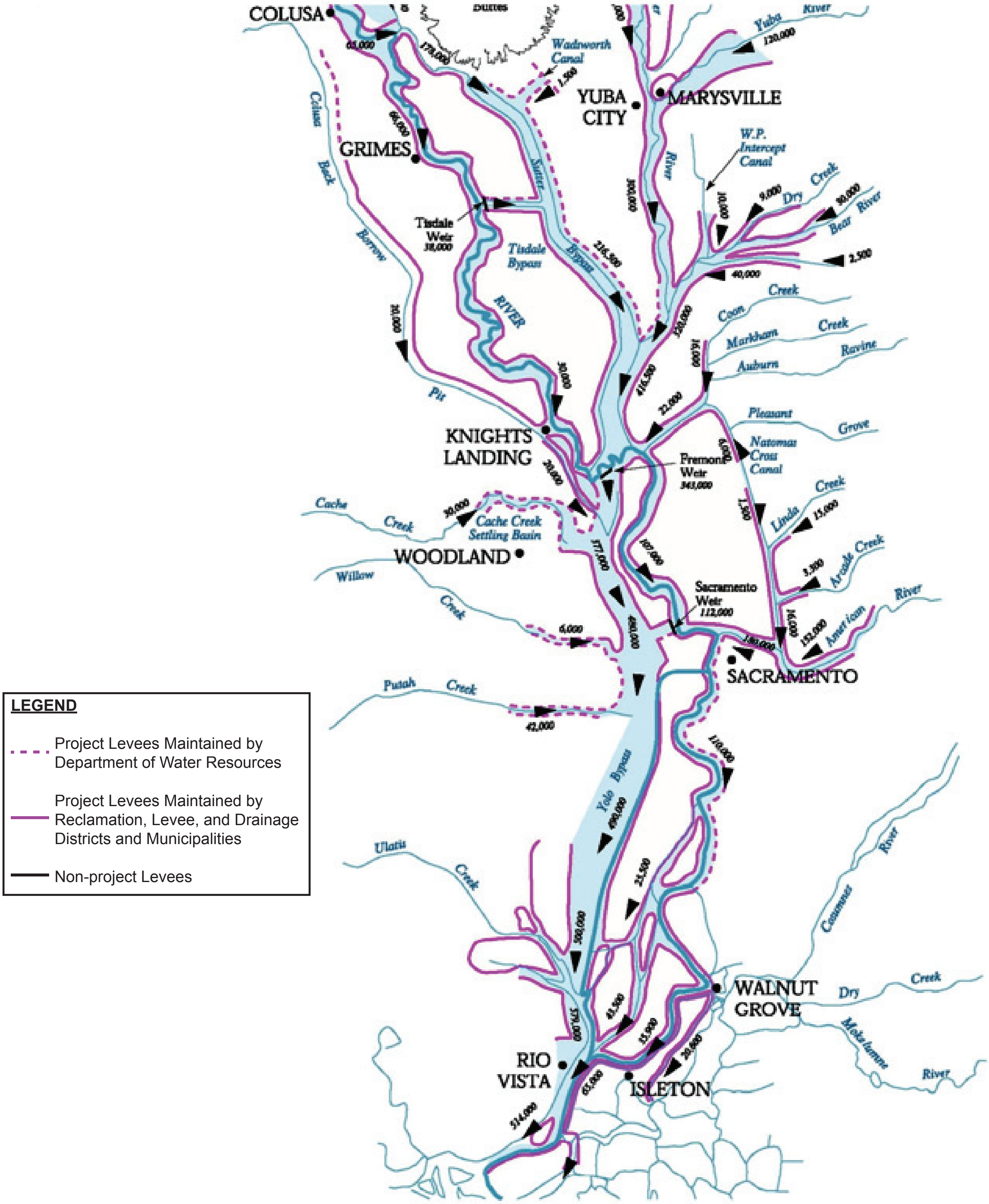
FIGURE 9-1
Overview of SPFC Project Works
North-of-the Delta Offstream Storage Project



Source: Modified from Department of Water Resources, Division of Flood Management, November 2003 Sacramento Valley Flood Control System Map.

N

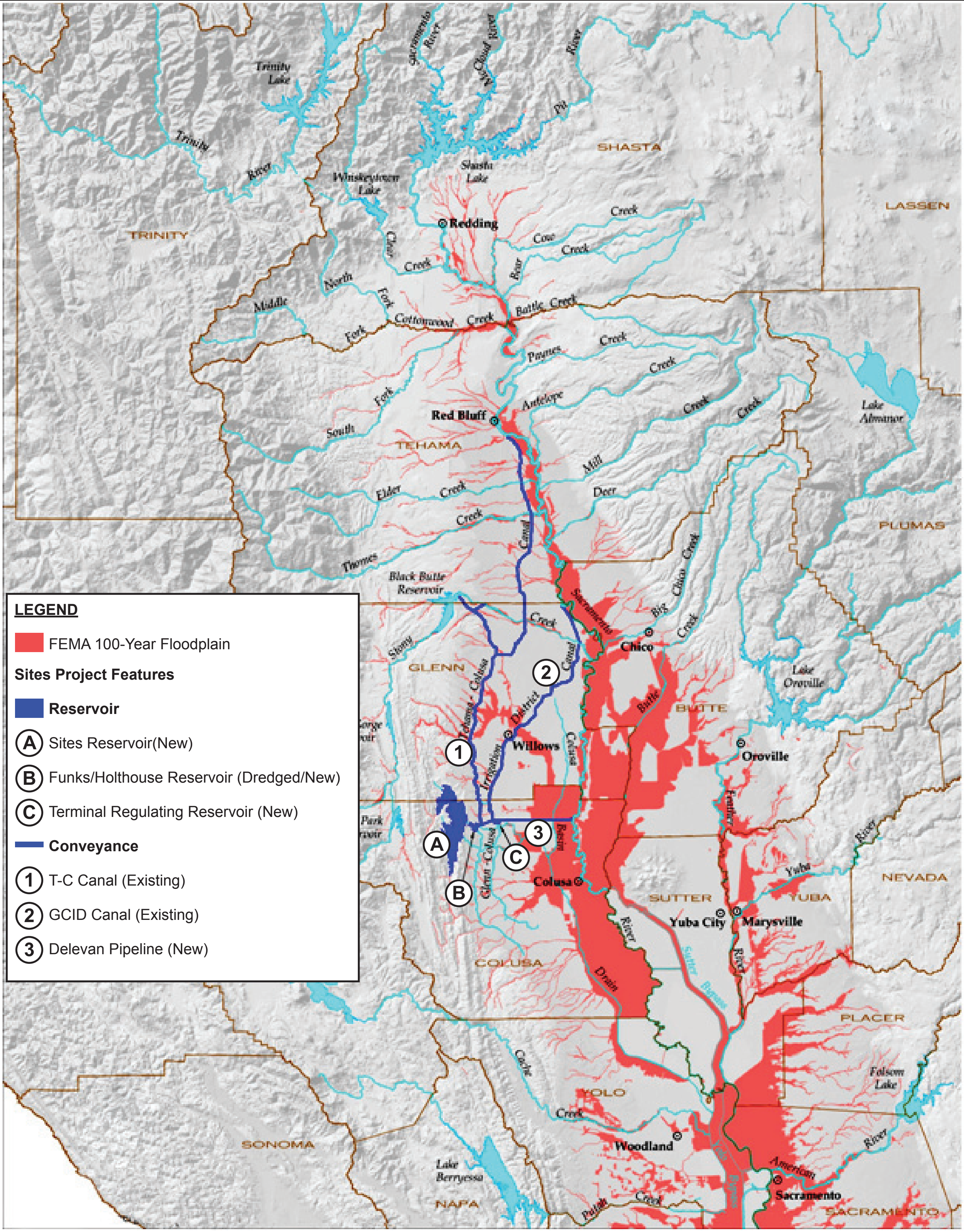
FIGURE 9-2A
Sacramento Valley Flood Control System Estimated Channel Capacity (North)
North-of-the Delta Offstream Storage Project



Source: Modified from Department of Water Resources, Division of Flood Management, November 2003 Sacramento Valley Flood Control System Map.

N

FIGURE 9-2B
Sacramento Valley Flood Control System Estimated Channel Capacity (South)
North-of-the Delta Offstream Storage Project



Source: Federal Emergency Management Agency (FEMA), Q3 Flood Data.

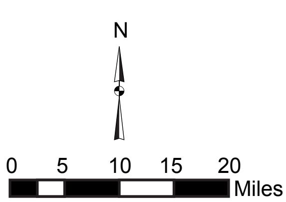


FIGURE 9-3
100-Year Floodplain Delineation Relative to the Project Facilities
North-of-the Delta Offstream Storage Project

WBG020812033556SAC

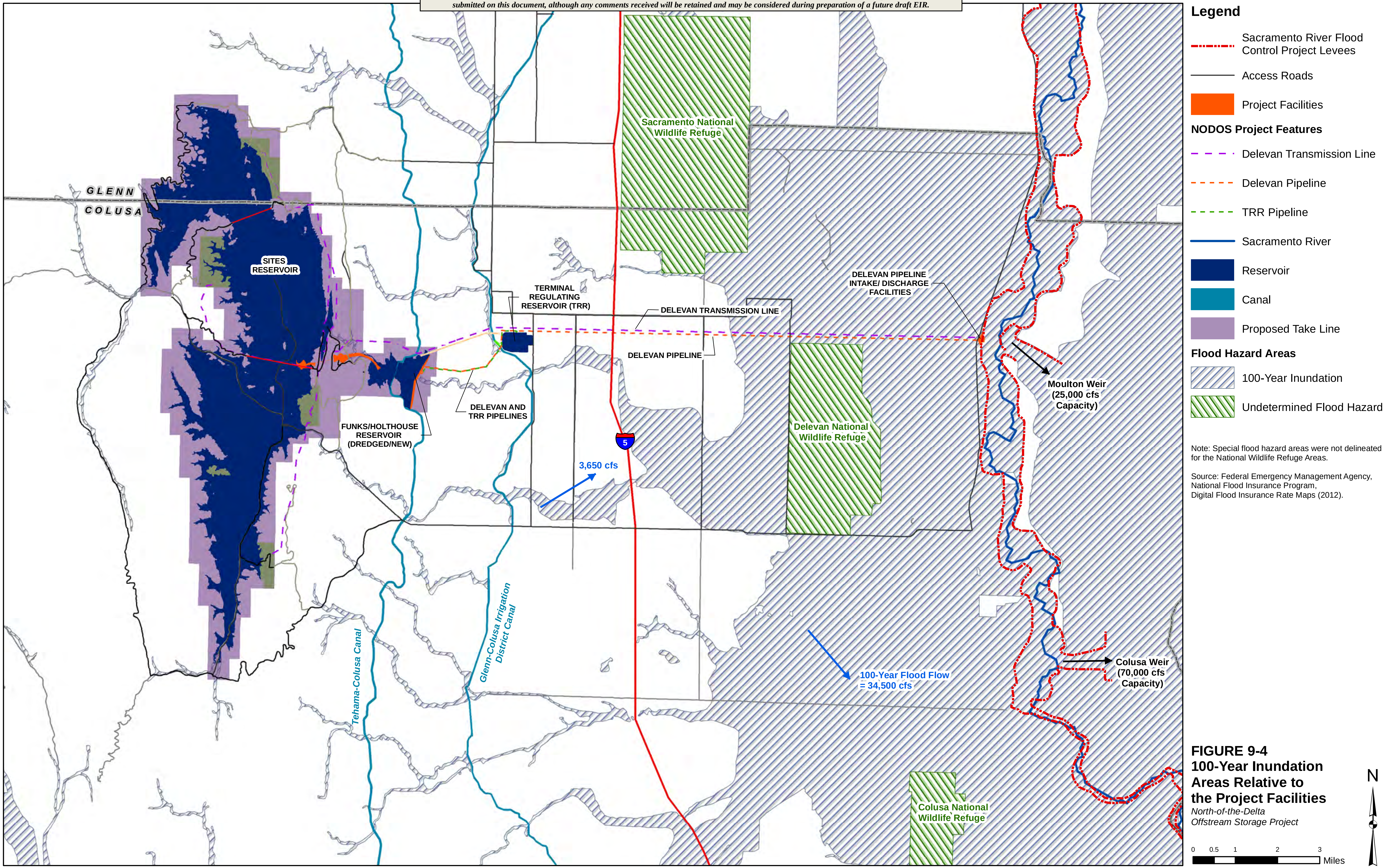
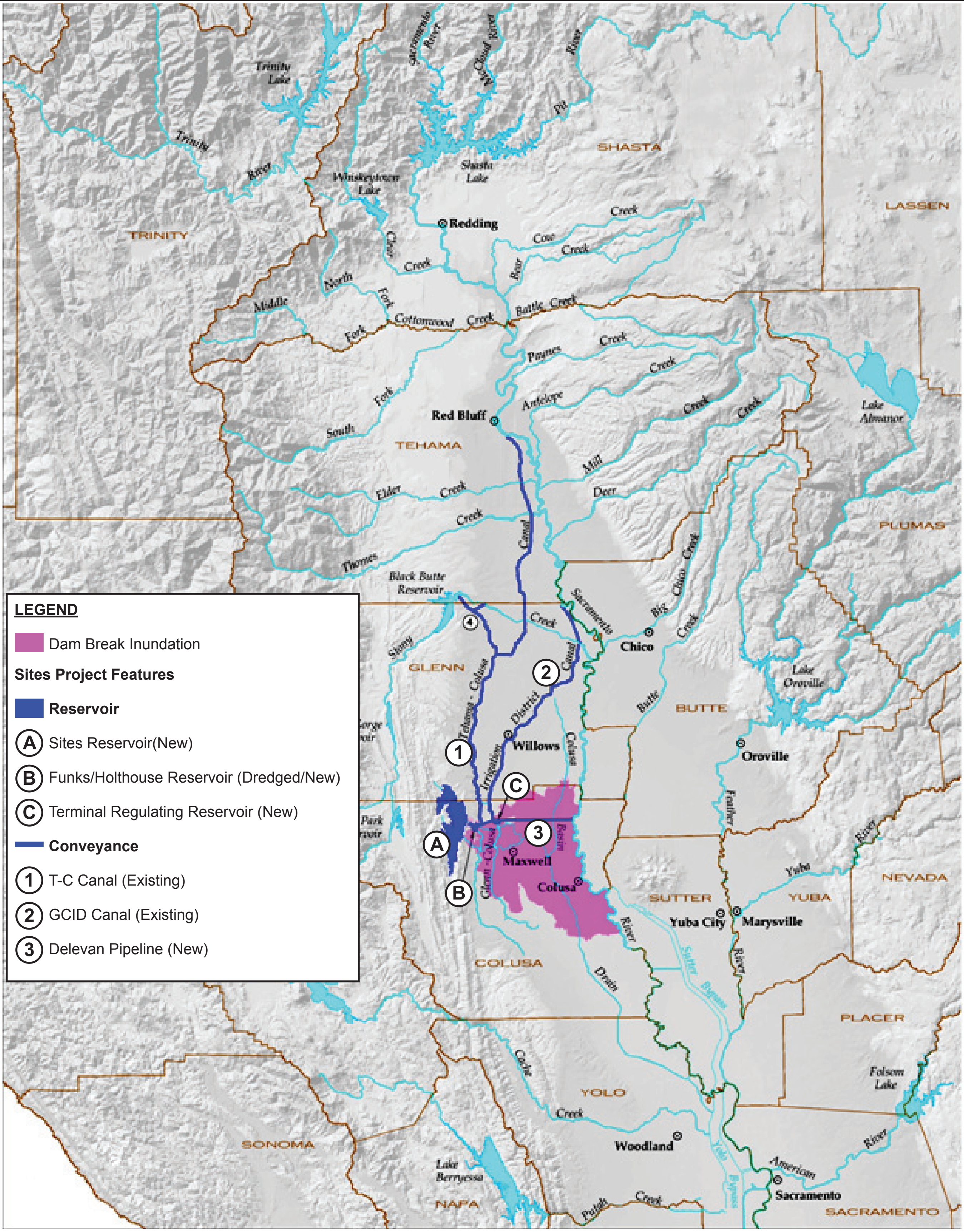


FIGURE 9-4
100-Year Inundation Areas Relative to the Project Facilities
North-of-the-Delta Offstream Storage Project

Path: W:\NODOS\MapFiles\Chapters\Flood\Figure9-5_Flood.mxd



Source: Federal Emergency Management Agency (FEMA), Q3 Flood Data.

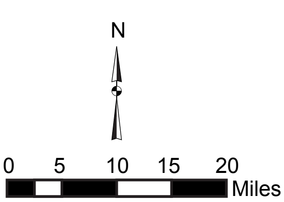


FIGURE 9-5
Dam Break Inundation Area for the Project Facilities
North-of-the Delta Offstream Storage Project